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Williams,  
J.

RECONNAISSANCE HYDROLOGIC SURVEY:  
AGUA FRIA WATERSHED

James Williams & Tom Elson



UNITED STATES GOVERNMENT Forest Service, Prescott National Forest,  
Prescott, Arizona

# Memorandum

2530

TO : Regional Forester

DATE: July 11, 1968

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FJB  
JWR  
E  
LW

FROM : R. W. Crawford, Forest Supervisor, By

SUBJECT: Hydrologic Surveys - Agua Fria Hydrologic Survey

Enclosed in final draft is a copy of the Special Purpose Reconnaissance Hydrologic Survey for the Agua Fria Watershed.

The watershed plan and stage I Multiple Use Survey have not as yet been completed, but will be forwarded as soon as possible.

The Forest is retaining two copies.

Enclosure

*William S. Holmes*

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JUL 12 1968

WM-S&PF  
Region 3





SPECIAL PURPOSE  
RECONNAISSANCE HYDROLOGIC SURVEY

AGUA FRIA WATERSHED  
Prescott and Tonto National Forests

June 26, 1968

Report by:

James Williams  
Tom Elson



## ABSTRACT

This is a special purpose reconnaissance hydrologic survey of National Forest lands within the Agua Fria Watershed above Lake Pleasant.

Conditions of flooding, loss of water storage due to sedimentation and shortages of runoff for downstream uses prompted the U. S. Forest Service to conduct the survey.

The field portion of the survey and methods of analysis were designed to provide a first approximation of the watershed's hydrologic condition and potentials for increasing water yield. Both quantity of potential yield and the geographic location of the opportunities have been determined and are identified.

Opportunities to increase water yield and to reduce sediment are of significant magnitude.

A comprehensive hydrologic survey is needed on areas within the Agua Fria showing the potential for intensive management prior to making the final and specific multiple use management prescriptions.

The purpose of this special purpose reconnaissance survey is to describe the general characteristics of the soils, geology, vegetation, and hydrology on National Forest lands within the Agua Fria Watershed. This description is necessary in order to identify areas with potential for water yield increase.

This survey describes the general location and management of potential areas for water increase. The potential areas will later have a comprehensive management survey which will go into greater detail and give a definite management plan for each of the potential water yield areas.



## SUMMARY OF SURVEY FINDINGS

### Watershed Characteristics

1. The National Forest lands consist of less than 50 percent of the watershed, yet they produce 79 percent of the water collected at Lake Pleasant.
2. There is no definite relationship between annual precipitation and annual runoff in the Agua Fria Watershed. Seasonal occurrence of precipitation and antecedent soil moisture exert strong influence on annual amounts of runoff.
3. Average annual rainfall ranges from less than 12 inches below the National Forest boundaries to more than 25 inches at the higher elevations within the National Forests.
4. Winter runoff from high elevation National Forest watersheds accounts for 94 percent of the annual runoff from these areas.
5. Runoff in the Agua Fria near Mayer has been below average for 18 of the past 26 years of record. The highest annual runoff was 53 times greater than the lowest. Runoff into Lake Pleasant has been below average for 41 of the past 79 years.
6. Average January runoff of the Agua Fria into Lake Pleasant is 31 times as much as the average June runoff. The maximum recorded January runoff is 376,000 acre feet (1916) and for the months of May, June and July no flow has been recorded 11 times since 1915.
7. Greatest variation of stream flow in the Agua Fria River occurs in January and the least in June.
8. Lake Pleasant's water storage capacity is reduced each year by 788 acre feet due to sedimentation.
9. National Forest lands contribute an estimated 19 percent of the sediment reaching Lake Pleasant.
10. Under intensive watershed management, the potential for sediment reduction from National Forest lands is about 83 acre feet annually.
11. About 50 percent of the National Forest lands occupy highly erodible granite soils. Steep slopes exist on over one-half of the National Forest lands.



12. Uncontrolled wildfire poses the greatest threat to soil stability on National Forest lands within the Agua Fria Watershed. Large destructive fires have occurred within the watershed and on similar areas.
13. Flooding is a potential hazard within the Agua Fria's flood plain both above and below Waddell Dam.
14. Uncontrolled wildfire is the most significant factor affecting flood peaks as they are related to National Forest lands within the Agua Fria Watershed.

#### Water Uses and Shortages

1. Most surface water needs on the National Forest are for livestock, wildlife, recreation and domestic uses.
2. Local use of water within the upper watershed is a small part of the total volume of runoff.
3. The bulk of the runoff is stored in Lake Pleasant and distributed to members of the Maricopa County Municipal Water Conservation District No. 1 (Beardsley Project).
4. Only about two-thirds of the Beardsley Project lands are farmed annually due to inadequate water supplies. Supplemental supplies are obtained by pumping ground water. The water table drops an average of 12 feet annually.

#### Opportunities to Increase Water Yield

1. There are 185,830 acres of National Forest land within the Agua Fria Watershed which show potential for increasing water yields. This acreage represents approximately 45% of the 415,907 acres of National Forest land.
2. The maximum potential water yield increase over potentially convertible chaparral covered lands in the National Forest portion of the Agua Fria Watershed is 0.15 area inches for a dry year, 0.46 area inches for the average year, and 1.12 area inches for a wet year. *= 7,123 Acre Feet*
3. Annual runoff from measured study watersheds has been increased by as much as 4 area inches on chaparral lands similar to those which are found within the Agua Fria Watershed.
4. Water need only be valued at \$15 per acre foot on site to equal conversion and periodic maintenance costs in the chaparral type. Water values in the Salt River Valley are estimated at \$20 per acre foot.



5. Chemical spray treatments every 3 years are expected to be necessary to hold the brush cover to less than 10 percent on areas converted from chaparral to grass.
6. Reducing soil moisture deficits in the headwater areas of the Agua Fria will be of greatest benefit in increasing annual flows. During high runoff years these areas reach zero soil moisture deficit sooner than lower areas.
7. The greatest opportunity for increasing water yield lies on the Prescott National Forest on the west side of the Agua Fria River. Although the Tonto National Forest offers few potential acres, the bulk of these acres show significant yield opportunities.
8. The chaparral vegetation type offers the most opportunity for increasing water yields. The ponderosa pine-mixed conifer type offers some opportunity as it is in the highest precipitation zone.
9. The opportunities for obtaining significant increases in water yield lie in those areas receiving 20 inches or more of mean annual precipitation.

#### Factors Requiring Special Attention

1. About three-fourths of the opportunities to increase water yield involves shallow soils of less than 20 inches at soil depth over fractured parent rock.
2. Over three-fourths of the potential water yield increase opportunities lie on soils which are comparatively low in productivity and easily eroded due to inherent characteristics of the parent rock.
3. About three-fourths of the opportunities to increase water yield are located on slopes between 30 and 60 percent gradient.
4. About one-sixth of the opportunities to increase water yield is located on soils with low rates of infiltration and percolation.
5. About one-third of the opportunities to increase water yield involves soil that is rated as having a high erosion hazard.
6. Depending upon the selection of prescriptions to manage the watershed lands intensively for water yield increase and sediment reduction, the potential increase in water yield ranges widely for a mean precipitation year.



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WATER RESOURCES IN THE AGUA FRIA WATERSHED



## 1.1 GENERAL DESCRIPTION

### 1.11 Location

The Agua Fria Watershed is located in the central portion of Arizona. It lies north of Phoenix and east and southeast of Prescott. Both State Highway 69 and Interstate Highway 17 cross the Watershed. The northwest and northeast portions of the Watershed include lands of the Prescott National Forest. The southeastern portion is located on the Tonto National Forest. The western, southern, and middle portions of the Watershed include BLM, State and private lands. (See Exhibits 1, 2 and 3).

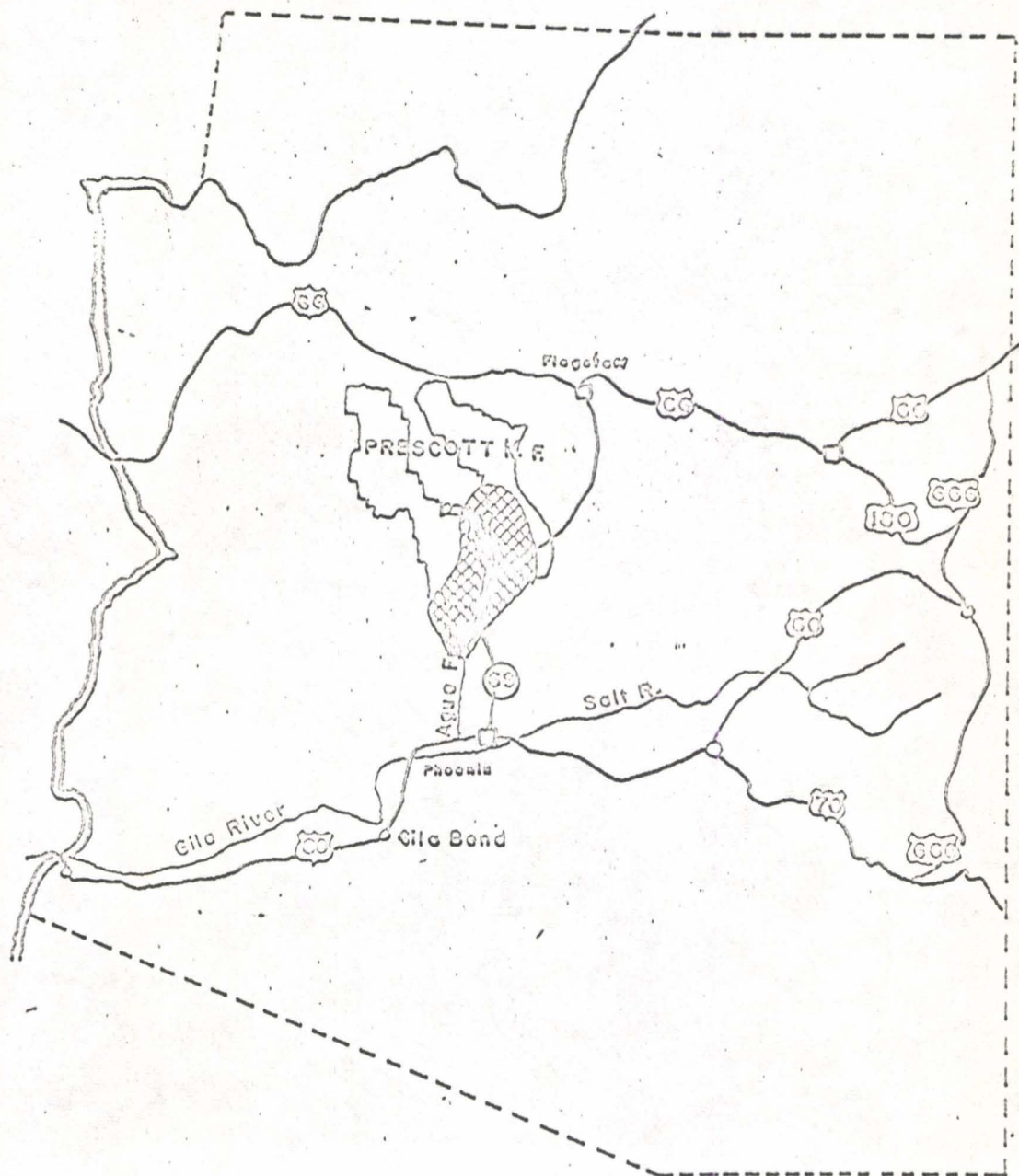
For purposes of identification, the part of the Agua Fria Watershed located on National Forest land is divided into National Forest System watersheds No. 6 (West Side Agua Fria) and No. 7 (East Side Agua Fria). These two National Forest System watersheds include portions of four Ranger Districts--Chino Valley, Verde, Prescott, and Crown King.

### 1.12 Watershed Characteristics

The Agua Fria River is a tributary of the Gila River and enters it just a few miles below the confluence of the Gila and Salt Rivers. The headwaters of the Agua Fria rise in the Mingus and northern Bradshaw Mountain areas at elevations of near 8,000 feet. From here the river follows a 115 mile course which drops initially at the rate of 300 feet per mile to a rate of about 10 feet per mile as it nears the Gila River at an elevation of about 900 feet.

The headwaters are very rugged, steep sloped mountain masses and mesa tops cut by deep vertical walled canyons. These mountain masses are predominantly granite and schist rock, while the mesas are formed by basalt flows. The residual soils are generally coarse and shallow with the exception of those formed on the basalt rock. Vegetation on these areas ranges from the sparse semi-desert shrub type near the base of the mountains, through dense brush covered midslopes, to stands of mixed conifer on the northerly aspects near the mountain tops.

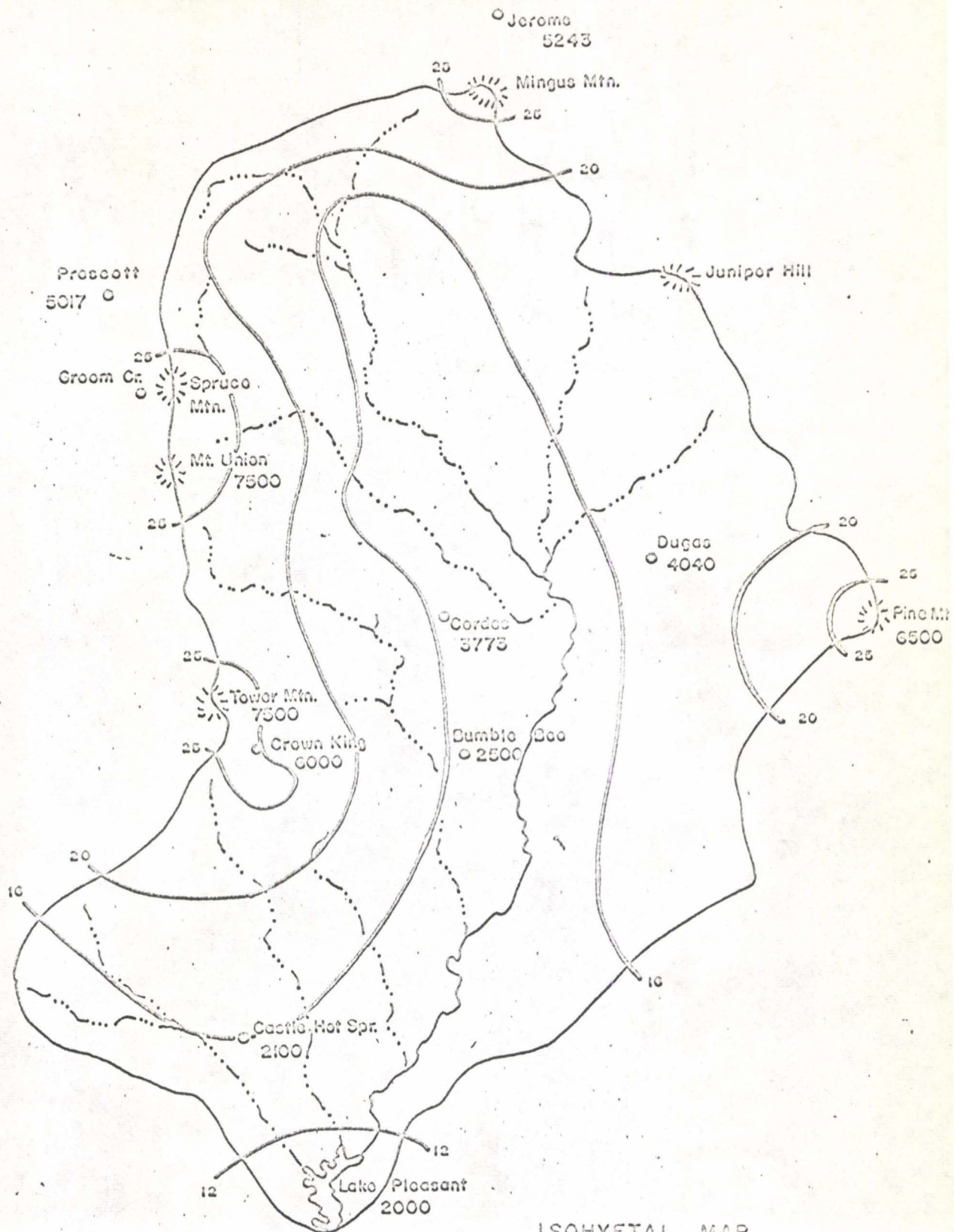
The remaining 30 percent of the Watershed is in a low lying valley. This valley, containing the water course of the Agua Fria Watershed, passes through a broad plain of water-deposited materials. The semi-desert vegetation, much of which is annual, is extremely sparse and the soils are fine textured clays and loams. Erosion is prevalent. Parts of the lower portion are intensively cultivated and irrigated.



LOCATION OF AGUA FRIA WATERSHED  
ON THE PRESCOTT NATIONAL FOREST

EXHIBIT 1



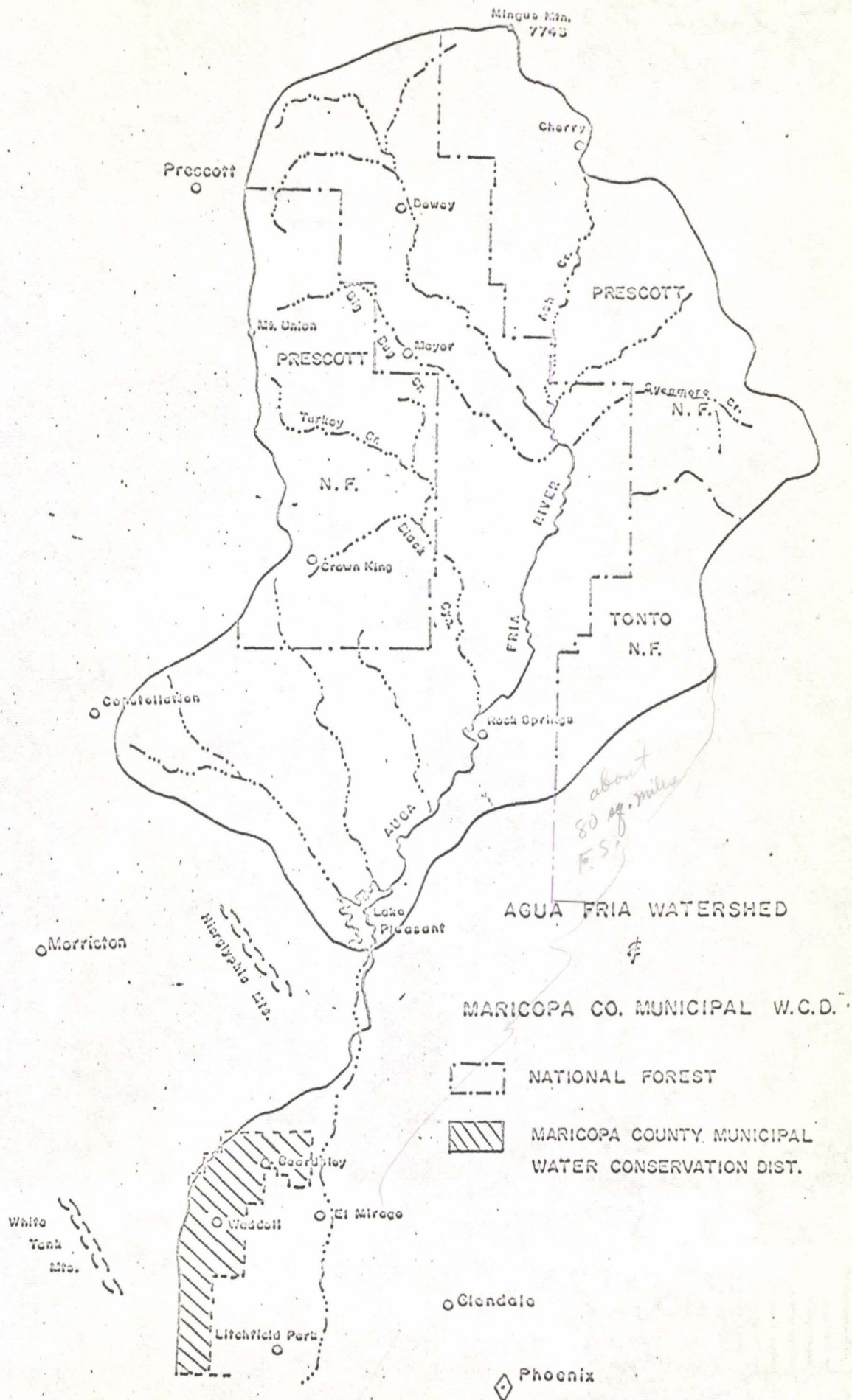


# ISOHYETAL MAP

## AGUA FRIA WATERSHED



EXHIBIT 2.





A desert climate, with slightly less than 8 inches of annual rainfall, prevails over the lower elevation portions of the watershed. High intensity summer thunder showers occur frequently. The high mountain areas receive in excess of 25 inches of annual precipitation, about 30 percent of which is in the form of snow from general winter storms.

### 1.13 Land Ownership

The Agua Fria Watershed above Lake Pleasant drains approximately 934,400 acres, of which 346,575 acres are within the Prescott National Forest and 69,332 are within the boundary of the Tonto National Forest. These combined acres of land managed by the Forest Service comprise 45 percent of the total watershed lands above Lake Pleasant. Approximately 5 percent of the watershed lands within the National Forest boundaries are privately owned. Most of the private lands are located on the Prescott and Crown King Ranger Districts and the majority of these private lands are patented mining claims.

*Total N.F.*

|                  |                |       |
|------------------|----------------|-------|
| Chaparral        | 168,863        | Acres |
| P-J              | 105,089        |       |
| P P              | 41,717         |       |
| Semidesert shrub | 69,807         |       |
| Grass land       | 30,431         |       |
|                  | <u>415,907</u> |       |

## 1.2 NATIONAL FOREST LANDS IN RELATION TO THE AGUA FRIA WATERSHED

National Forest lands occupy the highest elevations within the Watershed. These high elevation areas receive the greatest amounts of precipitation and yield approximately 79 percent of the runoff which reaches Lake Pleasant. For example, Crown King at an elevation of 6,000 feet receives an average annual precipitation of 27 inches in the form of snow and rain, and some local areas yield in excess of 16 area inches of annual runoff. Crown King has received more than 52 inches of precipitation in one calendar year. In contrast, the low elevation lands below the National Forests include areas receiving less than 12 inches of mean annual rainfall and yielding as little as 0.10 area inches of mean annual runoff.

Runoff from the higher elevation areas is generally of good quality. This is due to good vegetative cover on these lands managed by the Forest Service. The good ground cover protection and the high precipitation, some of which occurs in the form of snow, result in 93 percent of the runoff being generated from deep percolating waters during the winter and spring months. This water, in most years, is of great value and only infrequently has it been detrimental in the form of floods.

In comparison, runoff from the low elevation lands on the remainder of the Watershed is sediment laden and a greater portion of it occurs as summer flash floods. Vegetative cover is very poor, primarily due to low rainfall, and it is estimated that these lands contribute as much as 74 percent of the sediment reaching Lake Pleasant.

### 1.21 Water Use

Most surface water needs on the National Forest are for livestock, wildlife, recreation and domestic uses. For example, approximately 300 acre feet are needed annually for livestock and wildlife on the Prescott National Forest. In addition, it is estimated that 1600 acre feet of water on this Forest are used in conjunction with water oriented recreation and campground and administrative uses. The mining activities on the Crown King and Prescott Districts relay very little, if any, on surface waters. No diversions are made for the purpose of irrigating crops.

### 1.22 Forest Service Watershed Management

The Forest Service carries out a program of watershed management on the Agua Fria Watershed. This program gives consideration to four major elements. These are: environmental betterment; erosion control and sediment reduction; improvement of water quality; and increasing water yields. These elements are discussed in the following paragraphs.



#### 1.221 Environmental Betterment and Improvement of Water Quality

This aspect of Forest Service watershed management in the Agua Fria Watershed is orientated toward benefiting the total environment. Hydrologic surveys, analyses and plans are carried out to evaluate water resource problems and public needs. Inventories of hydroclimatological factors are made to better assess opportunities and limitations for intensive watershed management.

For example, water quality determinations are being made at regular intervals on three critical water-use areas on the Prescott National Forest within the Agua Fria Watershed. These permanent sampling stations are located at Lynx Lake, Horsethief Basin and Sycamore Creek. Data collected has already pinpointed a problem requiring special study and analysis. This problem involves a high concentration of copper which is entering Lynx Lake and which may pose a serious threat to realizing the full potential of this fisheries facility. (See Appendix VI for a summary of water quality data).

Most watershed management efforts in environmental betterment in the Agua Fria Watershed involve coordination of other Multiple Use resource management activities to protect favorable hydrologic conditions. These activities consist of recreation, livestock and wildlife uses, timber harvests and special uses such as mining access roads.

#### 1.222 Erosion Control and Sediment Reduction

Steep slopes occupy over one-half of the National Forest lands within the Watershed. These slopes are covered with chaparral species which in some cases reach crown cover densities of over 60 percent. When chaparral cover becomes this dense, it provides excellent protection to the soil surface. However, 47 percent of these lands contain soils developed upon granite rock. Granitic soils are, by character, highly erodible due to a lack of cohesiveness. When these soils are exposed to raindrop impact and surface flow, they erode rapidly and severely. Their rates of infiltration and percolation are high--often as high as 5 inches per hour--but their shallow depth limits their detention storage capacity. This often results in surface runoff and soil movement during prolonged periods of high rainfall. Retention capacities for soil moisture are low. These are sometimes less than 1 in. per foot of soil depth. In these cases there may be insufficient moisture available to maintain shallow rooted species which do not have access to water stored in the fractured rock mantle below the developed soil. All of these



factors contribute to the high erosion hazard characteristic of granitic soils. For a comparison of these properties and characteristics with soils developed from other rock types, see Table 3, Appendix II.

Uncontrolled wild fires are the greatest potential cause of accelerated erosion. The next greatest erosion problem results from old mining claims and their access roads. Many of these problems are located on private lands not administered by the Forest Service. Many more exist in violation of mining laws and Forest Service regulations.

Timber access roads are drained and seeded after they have served their purpose. Several erosion control projects have been carried out successfully by the Forest Service in the past 5 years within the Watershed. They are the Brady Butte Erosion Control Project and Range Revegetation Projects (root plowing) on the Mulberry and Bottle Allotments.

Burned areas are reseeded immediately after the fire is controlled. For example, portions of the 1956 Mingus Burn in the upper reaches of the Watershed were revegetated with grass successfully immediately after the fire. This area has now recovered and is gradually almost entirely regrown to returning to its pre-fire cover of chaparral species.

An extensive inventory is available which lists restoration needs on National Forest lands in the Agua Fria Watershed. On the Prescott National Forest alone, approximately 114 miles of gullies are in need of stabilization; almost 90 thousand acres are in need of sheet erosion control; 235 miles of roads need to be drained and revegetated; and 200 acres of mine disturbance must be restored with a vegetative cover. (See Table 2, Appendix V). These items are not all inclusive, but they alone represent a need for slightly less than \$1,000,000.

Tables 1a, 1b and 1c in Appendix V list potential decreases in average annual sediment yields which would result from an intensified watershed management program. The reductions shown apply to three source areas. These are: (1) sheet erosion which is assumed to be reduced upon conversion from chaparral to grass, (2) gully erosion, and (3) erosion from roads. These tables show a potential reduction in sediment yields of about 83 acre feet per year from National Forest lands.



Although the need for restoring good watershed conditions on National Forest lands in the Agua Fria Watershed is great, the magnitude of sediment production is small when compared to low elevation non-National Forest lands making up the 55 percent of the Watershed which produces an estimated 74 percent of the sediment. Sediment rates on these lands may exceed those on National Forest lands at higher elevations by as much as 50 times. The water holding capacity of Lake Pleasant is reduced 788 acre feet (0.54 ac. ft. per sq. mi. per yr.) each year due to sedimentation. Although most of this material comes from the pinyon-juniper, semi-desert shrub and grass-land zones, the rate could be substantially increased if large acreages of chaparral should burn uncontrolled.

The Soil Conservation Service has developed a sediment source map which is included in the maps in the back. Table 4, Appendix V, summarizes the information on this map. Prescott National Forest lands produce 12% of the total sediment on the West side Agua Fria Watershed and 11% of the total sediment on the East side Agua Fria Watershed. The Tonto National Forest portion of the Watershed produces 3% of the total. Endeavors to maintain or reduce erosion on National Forest lands is an important aspect in watershed management in the Agua Fria Watershed.

### 1.23 Increasing Water Yields

Increasing water yields on a program basis has not been done within the Agua Fria Watershed, although secondary and incidental benefits have accrued where other Multiple Use resource programs have reduced evapotranspiration drafts upon soil moisture. This element of watershed management has been scientifically proven and it is now in its maturing stage. Research is presently in progress on the small Mingus Mountain Study Watersheds within the Agua Fria Watershed and the White Spar Watersheds nearby to further the knowledge already gained. As pilot projects have pointed the way to more economical management methods and techniques, increased public enthusiasm has developed. A projection of research findings indicates that in the West 9 million acre-feet of increased water yield can be obtained from forest, brush and alpine watersheds for an average annual cost of 13 million dollars. 1/ Much of the remainder of this survey report will deal with opportunities to increase water yields within this central Arizona watershed.

*Overly optimistic!*

1/ Beattie, Byron. Harvesting the National Forest Water Crop. Presented at 36th Annual Convention of the National Reclamation Association, Honolulu, Hawaii, November 1967.



1.3 THE SITUATION ON OTHER THAN NATIONAL FOREST LANDS WITHIN AND  
ADJACENT TO THE AGUA FRIA WATERSHED

1.31 Irrigation Water Use and Shortages

The local use of runoff water within the upper watershed is a very small percentage of the total volume of runoff. Most of the communities and farmers within the upper watershed depend upon wells for water. However, it is known that the Orme's, Fain, Bridge, Chauncey and Land Air Corporation farms use irrigation water from the Agua Fria.

Water is diverted above Lake Pleasant for mining and for not over 1,000 acres of irrigated land. There are diversions for mining and about 600 acres of irrigation above the stream gage at the Sycamore damsite near Mayer. The average diversion in the Perry Canal just above this gage was 240 ac. ft. per year for the 1950-1960 period. Maximum yearly diversion for this period was 580 acre feet (less than 1 ac. ft. per acre) and no flow was diverted in water year 1960.

The community of Mayer uses runoff water from the Agua Fria for municipal use. Water is pumped from a gravel basin in the river bed which is dependent upon stream flow for recharge.

Norman Fain uses 55 acre feet per year for irrigation from Lynx Lake. The 55 acre feet is measured at the delivery point and not from the Lake. This withdrawal lowers the water level in the Lake from 6 to 8 feet.

1.311 Maricopa County Municipal Water Conservation District  
Number One 1/

The remainder of the Agua Fria's flows are stored in Lake Pleasant dam from which the water is distributed to project lands in the Maricopa County Municipal Water Conservation District Number One.

This district was originally organized under the laws of the State of Arizona in 1925 as the Beardsley-Agua Fria Water Conservation District. The name was changed that same year to its present name, although it is still referred to commonly as the Beardsley Project.

The district lies approximately twenty-five miles west of Phoenix in Maricopa County. It occupies that

1/ Most of the following information was supplied by H. S. Raymond, District Engineer, MCMWCD#1. See his letter dated April 24, 1968, labeled Exhibit 1, Appendix 1.



general area between the White Tank Mountains to the west; the Agua Fria River bed to the east, the town of Beardsley and U.S. Highway 89 to the north; and lateral 16 near Litchfield Park to the south. There are 33,666 acres within the District. (See Exhibit 3).

Waddell Dam, which impounds Lake Pleasant, is a district facility. Construction was completed in 1927. Water from the 157,000 acre-foot capacity reservoir is diverted from the Agua Fria River bed  $1\frac{1}{4}$  miles downstream. It is distributed from a main canal which is 33 miles long.

The Agua Fria has not consistently supplied sufficient water to meet the needs of the project lands. Lake Pleasant has seldom contained more than 50 percent of its capacity and has often been below the minimum level for release. Water was spilled in 1966 for the first time since 1941. This was the only water not utilized by the project during this period. The dam was constructed on a hydrologic design based on an average annual flow of about 189,000 acre feet. Since the construction of the dam, the average flow has been 41,000 acre feet. (See Exhibit 4). Only about two-thirds of the project lands have been farmed annually due to an inadequate water supply. Keeping this much acreage in production has been made possible by the drilling of 120 irrigation wells during the period 1939 to 1947. As a result of heavy pumping the ground-water table drops about 12 feet each year. The average lift is now 525 feet. (See Exhibit 5).

Much has been done within the district on water conservation practices to use the limited supply of water more efficiently. Ninety percent of the district's distribution system is concrete lined. Within two years the remainder will be lined. Other practices undertaken by project landowners include land leveling, lining irrigation systems, and recovery of tail-water. In one case, an experiment is underway to develop an automatic irrigation system.

The future potential of the district to produce agricultural products is very good providing that supplemental supplies of water can be obtained. The present water supply from both surface and ground water sources is of good quality. The sandy loam soils grow excellent crops. There is little likelihood that this area will be converted from farmland to residential use. This is



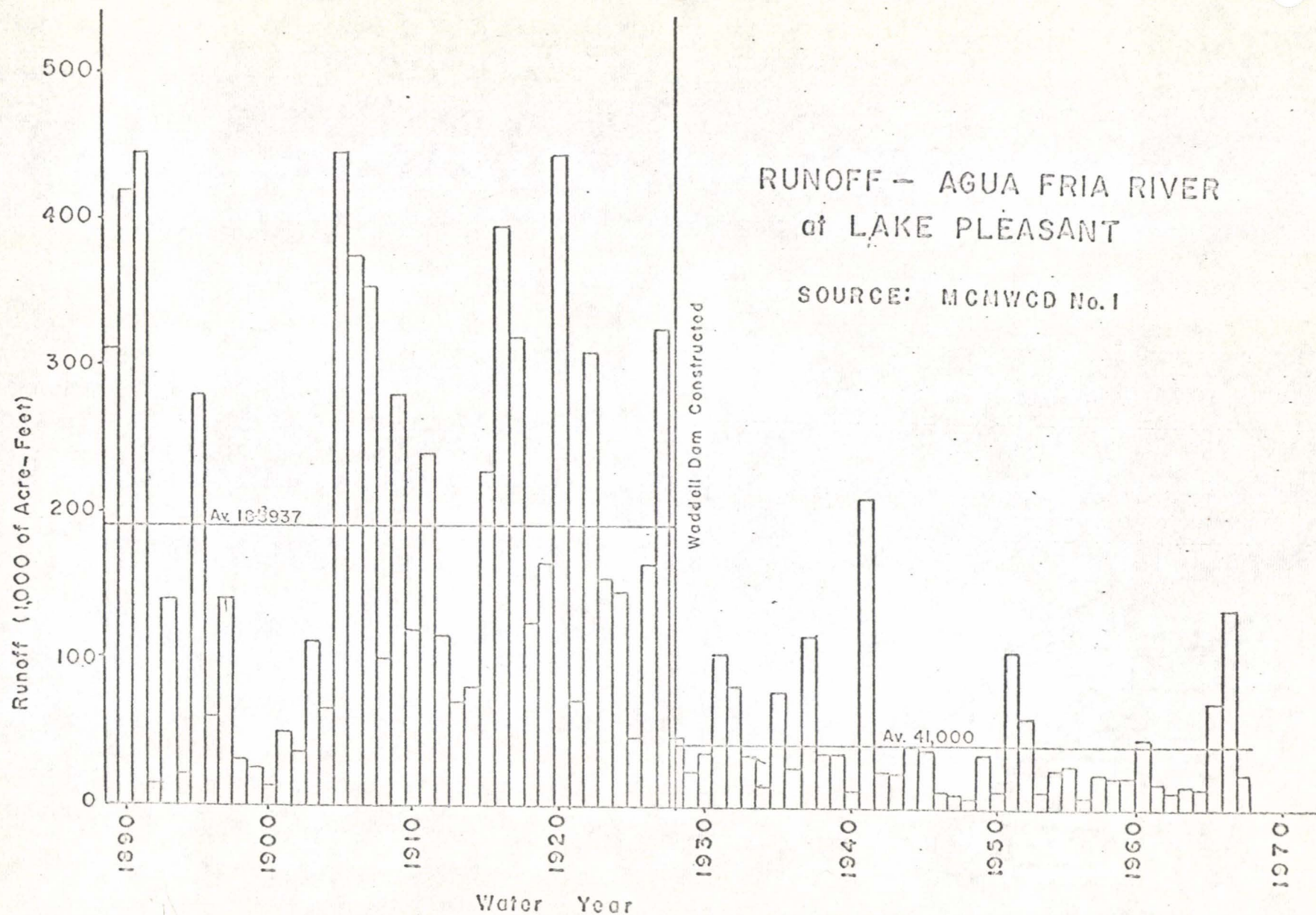


EXHIBIT 4

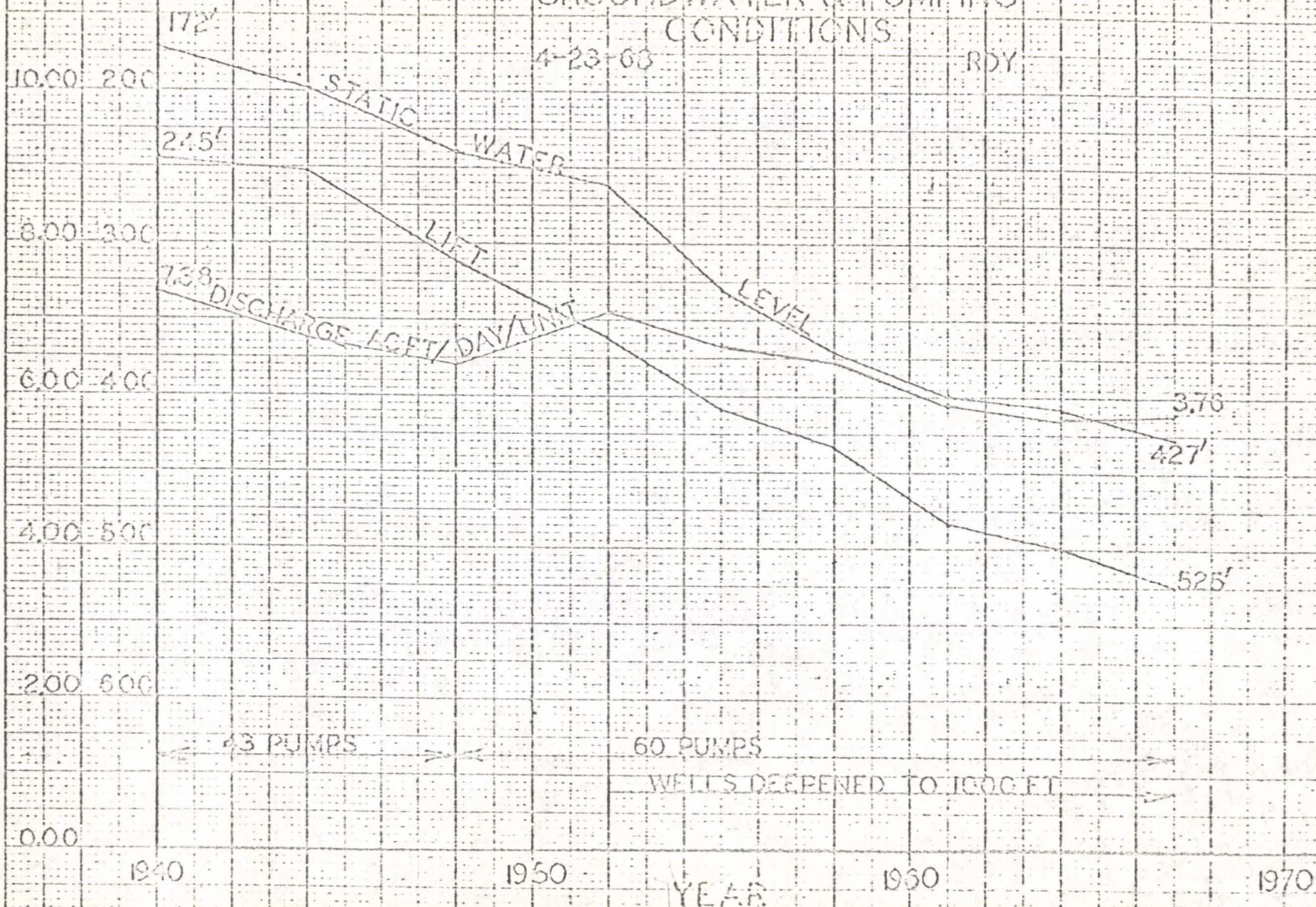


# MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. ONE WELLS

## GROUNDWATER & PUMPING CONDITIONS

4-23-68

RDY





due to its remoteness in relationship to the expanding fringes of the Phoenix Metropolitan area. Stable crops such as citrus, roses, and grapes have been increasing in acres grown in recent years. (See Table 1, Appendix I). Other important crops for which conditions are good include cotton, fall and spring lettuce, grains, potatoes, onions and melons.

The district has stated that it would appreciate "... help in establishing a watershed management program that would result in a higher water yield. . . ." (See Exhibit 1, Appendix I).

### 1.32 Floods and Flood Damages 1/

#### 1.321 Upper Agua Fria Flood Plain

Damages resulting from floods occur annually to ranches, farmlands and other property in the Dewey and Humboldt area. The mean annual flood along this section of the Agua Fria is 5800 cubic feet per second. The floods to date have not been extensive or of long duration. Flooding occurs in a narrow strip along the main Agua Fria Wash on private and State owned lands. The maximum flood of record at the Sycamore Dam Site near Mayer was 13,000 c.f.s. or approximately 22 cubic feet per second per square mile.

Good vegetative watershed cover is present on most National Forest lands in the Agua Fria Watershed. These lands when in good condition contribute much less per unit area to the higher frequency flood peaks than the private and State lands at the lower foothill levels near the main channel. As the antecedent conditions for flooding increase, the differential contribution from National Forest lands would decrease due to the reduced water holding capacity on shallow soils. Floods may occur in summer or winter. The largest flood recorded on the Upper Agua Fria was a winter storm which occurred on March 1.

One-hundred-nineteen peak discharges have been recorded for the Upper Agua Fria above the Sycamore Dam site since 1940. Nineteen of these peaks occurred during the period October 1 through April 30. The remaining 84% occurred during the summer months. Uncontrollable wildfires would have the greatest influence on adversely affecting flood peaks within the Agua Fria Watershed. An extremely hot fire is particularly critical as it

1/ See Appendix IV, Section 2b.



affects the ability of the soil mantle to infiltrate high intensity convective summer rainfall. Management to reduce floods from summer thunderstorms primarily through protection against wildfires is an important aspect to be considered in the Upper Agua Fria.

#### 1.322 Lower Agua Fria Flood Plain

An intensive survey and analysis has been completed by the Corps of Engineers for the Lower Agua Fria flood plain. (See Appendix IV, Section 2b). The survey covered the 23-mile reach from a short distance below Waddell Dam to Camelback Road near Litchfield Park. The two greatest floods during the past 100 or more years occurred in January 1916 and November 1919 both generated by winter storms. These floods were prior to the construction of Waddell Dam in 1927. The estimated discharge of each of these floods was 105,000 c.f.s. There are no concentrated developments on the flood plain, but Avondale does receive flood forecasting services from the U.S. Weather Bureau and several highway and railroad bridges cross the river bed. Agricultural activities predominate within the zone of flooding.

The flood of 100 year frequency is estimated by the Corps to be 59,000 c.f.s. just below Waddell Dam and 95,000 c.f.s. at Camelback Road. The most severe flood for which it is practicable to anticipate would peak at 65,000 c.f.s. just below Waddell Dam and 190,000 c.f.s. at Camelback Road.

The Corps does not propose flood-control measures on the Agua Fria itself. However, a project has been authorized on New River and its tributaries. 1/ The Corps study will facilitate safe planning of future improvements within and adjacent to the flood plain.

Theoretically, National Forest administration would have little influence on the typical small watershed in the Agua Fria covered by the most severe storm and antecedent conditions in regard to the flood peaks dealt with by the Corps. These floods would still be large and devastating. As discussed before, the antecedent plus storm precipitation is assumed to have greatly depleted the available natural detention and retention water storage

1/ For proposals see Interim Report on Survey for Flood Control Phoenix, Arizona and vicinity, U.S. Army Engineer District, Los Angeles, Corps of Engineers, November 15, 1963.



capacity. Realistically though, many intermediate floods occur when this is not the case uniformly over the watershed. In these situations, National Forest administration can have appreciable effect in reducing the magnitude and frequency of floods. The condition of the watershed would be particularly effective around the fringe areas of the heaviest portion of the storm cell in directly reducing rapid surface runoff. Detaining surface runoff by only 0.1 inch can redistribute flood flow volumes under the hydrograph amounting to 5.33 acre feet per square mile. Depending upon the characteristics of the watershed affecting the time of concentration, the effect of such a reduction on peak discharge could amount to several thousand cubic feet per second. In addition to maintaining usable natural detention and retention storage capacity, good watershed conditions provided by good vegetative cover extend the effective period of storage capacity artificially provided by impoundments such as Waddell Dam and smaller storage facilities. This is done by reducing the rate of sedimentation.

Since artificial total detention capacity for the Standard Project Flood is not available on the Agua Fria, the contribution of watershed condition takes on much more significance and should be considered in the management of National Forest lands. Similar to the Upper Agua Fria, floods on the Lower Agua Fria would be most significantly affected through National Forest administration by maintaining satisfactory watershed conditions. These conditions require that large wildfire conflagrations be controlled. Dividing large continuous blocks of dense chaparral into small isolated units covered with grass is one means of effecting such control.



## 1.4 WATER YIELDS ON NATIONAL FOREST LANDS

### 1.41 Present Water Yields

National Forest lands comprising 45% of the Agua Fria Watershed produce 79% of the average annual runoff into the Lake Pleasant Reservoir. The National Forest lands are located in the higher precipitation zones and, therefore, produce the greater amount of water.

Average annual water yield reaching Lake Pleasant from National Forest lands in the Agua Fria drainage is estimated to be 48,526 acre feet (1.40 area inches) annually. Average annual water yield from Non-National Forest lands is estimated to be no more than 12,944 acre feet (0.30 area inches) annually.

The high water producing areas on the watershed are the Crown King, Mingus Mountain, Pine Mountain and Lynx Creek areas. Computations show that some units may yield in excess of 16 inches. They are all in the higher precipitation zones with a heavy snow pack during the winter which may in high precipitation years reach near 4 foot depths and contain in excess of 15 inches of water. Precipitation and type of vegetative cover are the major limiting variable factors affecting the amount, timing, and quality of the water produced on the watershed.

Based on eight years of records at the White Spar Watersheds, winter runoff from high elevation watersheds is 94% of the total annual runoff on these sites. Whereas, winter runoff at Waddell Dam for the past 38 years shows an average of 74% of the annual runoff received at the dam site. Higher soil moisture deficits during the summer months at the lower elevations and runoff which occurs mostly as flash floods when the rainfall intensity exceeds the infiltration rate, cause this difference in water yield timing.

The largest percentage of the water produced comes from the 18 inch precipitation zone. Although the highest producing lands are generally in the 25+ precipitation zone, the acreage is not nearly as large as that contained within the 18 inch zone.

### 1.42 Potentials for Increasing Water Yields on National Forest Lands Within the Agua Fria Watershed

Due to the great need for supplemental water by the downstream users in the Agua Fria, and also due to the inter-relatedness of water production and the management of brush and forested lands, the Forest Service has included in this reconnaissance survey the determination of potential opportunities to increase water yields. This action is based upon research findings on similar watersheds which have proven the practicability of Multiple Use programs to increase water yield.



1.421 Water Yield Increase Projects on Comparable Watersheds in Arizona

The Three-Bar chaparral watersheds near Lake Roosevelt, Arizona were set up in 1956 to study effects of brush control on water yield, erosion, and game habitat. The chaparral was burned off by wildfire in 1959; as a result the water yield was increased about 3.0 area inches more per year under a grass cover than would have been produced if the watershed had remained covered by chaparral. Runoff was highest immediately following the fire reaching as high as 4 area inches on a 77 acre watershed. By the end of the fourth year the control watersheds were approaching prefire conditions. In the watersheds sprayed by herbicides to favor grass, the increased runoff has been maintained as compared to the watersheds allowed to regain a natural shrub cover. Similar results have been obtained on chaparral covered watersheds in California.

Follow-up chemical spray treatments every three years are expected to be necessary to hold the brush cover to less than 10 percent. This amounts to twelve spray treatments over a 30-year period. Using a cost of \$8.12 per acre per treatment and discounting this cost at 4 percent, the value of water produced by the treatment must equal \$3.67 per acre per year to offset the treatment cost. If water alone was the only benefit and 1/4 acre-foot per acre per year was the increase, then the water must be valued at about \$15 per acre foot to equal costs. However, other benefits accrue and it has been shown that a benefit to cost ratio of 2 to 1 is possible on the basis of water being priced at \$20 per acre foot.

Water yield results from Workman Creek Watershed in the pine-fir vegetation type at the Sierra Ancha Experimental Forest in central Arizona averaged an increase of 144 percent on an annual basis. This increase occurred from a clearcut of 80 acres on a 248 acre watershed. Stream flow was increased approximately 46 percent. This amounted to an average increase of 1.2 inches over the entire watershed or 0.3 foot over the treated 80 acre area.

1.422 Predictions of Increased Water Yields are Based Upon Physical, Biological and Climatic Factors

The water increase data presented in this report was prepared by the Pacific Southwest Survey team in Tempe and was sent to the data processing laboratory in Berkeley, California for machine computation. Water increase figures are based on a computation of water use by deep-rooted



species. The results of example computations are shown graphically in Exhibit 6.

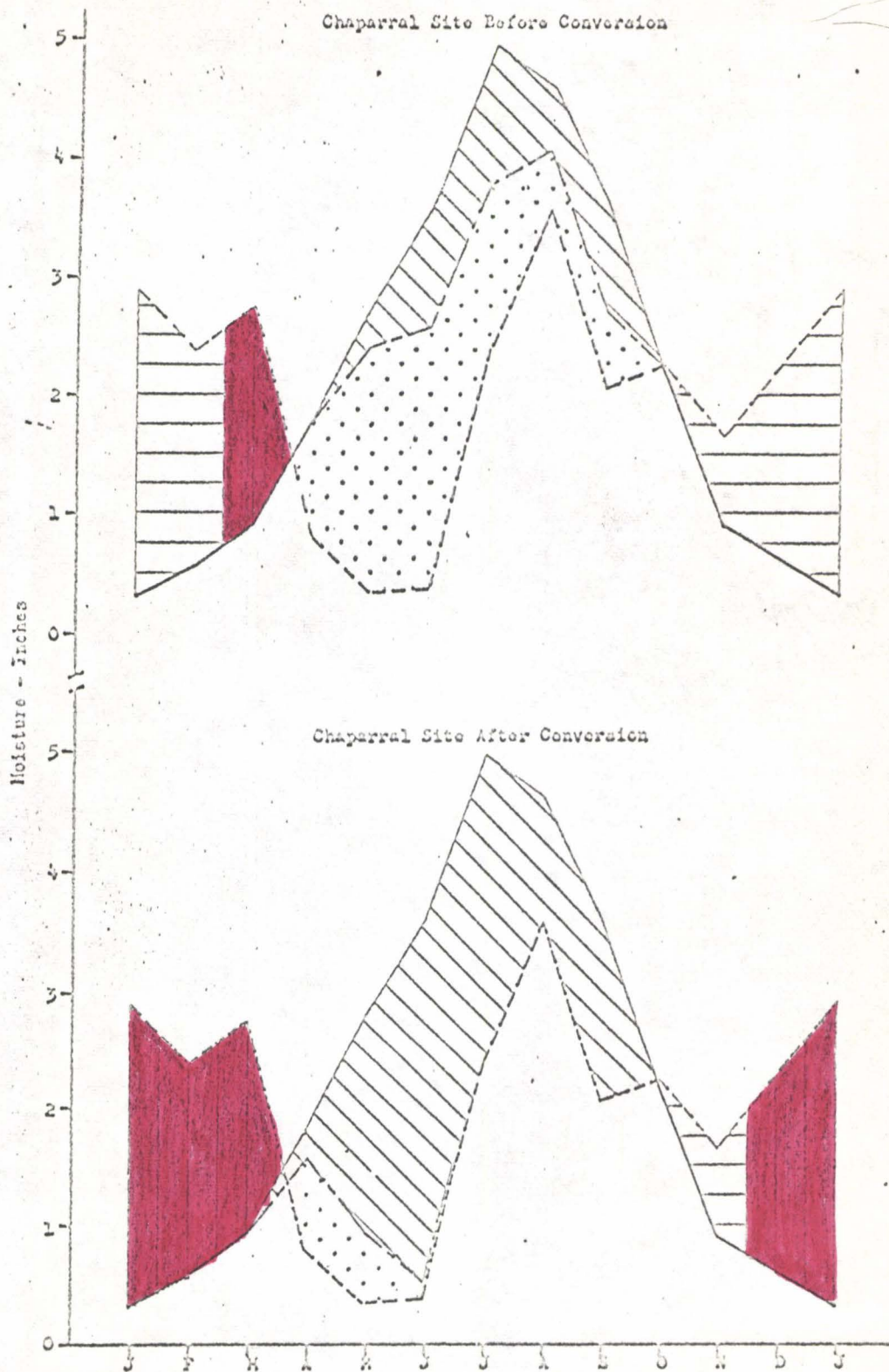
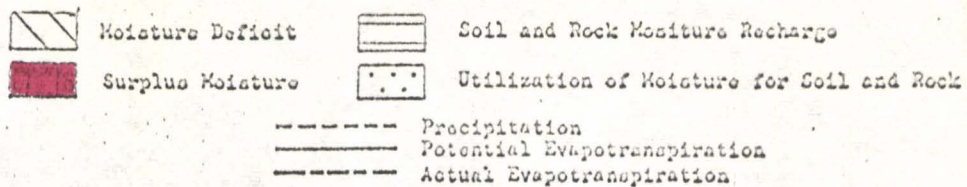
The field survey and the computations for sediment and water yields include 162 hydrologic response units on National Forest lands within the Agua Fria Watershed. Hydrologic response units are homogenous units which respond uniquely to different inputs of factors affecting hydrologic performance. For example, a different response would result from a change in vegetation, precipitation or land uses. One inch to the mile maps are contained in the map envelope on the inside of the back cover of this report. The map legend on the face of the envelope describes the symbol arrangement and provides quantitative conversion figures. The data shown for each hydrologic response unit (and other data not shown) was collected by field sampling and typing.

Water increase figures are shown as on-site increase and not as water received at some downstream delivery point. No conveyance losses are considered. On-site water yield may be depleted as it leaves the site by channel seepage, deep seepage, evapotranspiration by stream channel vegetation and soil moisture storage. No studies have been made to determine these losses in the Agua Fria Watershed. Some channels will be more efficient conveyors than others. Channel variation and conveyance losses are most significant on lands below the National Forest boundaries.

Exhibit 6 shows the potential increase by conversion of chaparral to grass. Potential evapotranspiration is the amount of water that could be used by the plant if water was not limiting. Actual evapotranspiration is the amount of water used by plants. When potential exceeds actual evapotranspiration, then all the available moisture is used by the plants. When precipitation exceeds potential evaporation, there is a moisture surplus which is stored in the soil or is released as streamflow.

By reducing the depth of roots, the moisture stored in the soil is not depleted and therefore any additional water entering the soil occurs as deep percolating water for stream flow. This survey is based on this fact.





Relation of Precipitation to Potential Evapotranspiration and Actual Evapotranspiration for the Mine-Boulder Mountain Conversion Area



1.4221 Methods to Convert Deep Rooted Species to Shallow Rooted Species

1. Prescribed burning

Broadcast burning of isolated blocks or strips of chaparral. This method is used where the canopy is dense or there is a heavy grass understory and the unit is isolated from large continuous masses of fuel. Cool or hot burns and special patterns of burning offer alternatives to meet special needs.

2. Chemical herbicides

Used as follow-up maintenance on burned areas and selected areas for conversion where fire cannot be used.

3. Root plow

Used on the contour on moderate slopes where few rocks are present.

4. Even-aged timber management

1/6 regeneration cut for even-aged stands and normal 1/10 clearcut for roads, skid trails and landings. Patterns for the regeneration cut are oriented for most effective influence on increasing water yield. The 1/10 clearcut reduces evapotranspiration, interception and results in redistribution of the snow pack on a permanent basis. The 1/6 regeneration cut aids snow pack redistribution for many years but has diminishing annual effects for reducing interception and evapotranspiration as regrowth takes place.

1.423 Potential Water Yield Increases

Water yield increases presented in this report represent the maximum potential in area inches for total conversion on large openings from deep rooted to shallow rooted species. They do not reflect any limitation due to multiple use coordination requirements or practical limitations of wildland management. For example, some units showing a potential will lie partly or wholly within management zones such as the travel influence zones designated



in the District Multiple Use Plans. Also, some units occupy sites where the slopes are steep and bouldery or have a high erosion hazard rating prohibiting conventional methods of conversion. Such limiting factors have not been incorporated into these data. On some hydrologic response units the indicated area inches of increased water yield may eventually be obtained over all of the unit, a part of the unit, or none of the unit depending on the Multiple Use management prescriptions. There is evidence that in the ponderosa pine and mixed conifer types of this watershed snow redistribution and reduced interception are factors requiring consideration in a program for increasing water yield. Redistributing snow results in accumulating sufficient water over certain soils so as to exceed the soil moisture deficit in the profile below. Studies are in progress in other Arizona watersheds to quantify these factors. The preliminary findings of this survey indicate that in one year out of four the snowfall in the higher elevations of the watershed is deep enough to be considered for snowpack management. (See Appendix IV.)

Snow pack redistribution and reduction of interception can be accomplished under intensive even-aged timber management where a 1/6 regeneration cut is made and a normal 1/10 of the area is clearcut in the form of roads and landings.

The highest potential water yield increase contained in the findings of this survey is 14.25 inches. This high potential increase sets the upper limit for a high precipitation year but is of minor practical significance. The hydrologic response unit from which such an increase is shown covers only 355 acres. The soil depth is 15 inches and only 1.6 inches of soil moisture storage would be available for a grass cover type. This unit lies on steep slopes within the 25+ inch precipitation zone on the West Side Agua Fria, Prescott National Forest.

Hydrologic response units showing no potential increase lie mainly within the 14 and 18 inch precipitation zones but occur in all, including the 22.5 and 25+ zones. The largest portion of no potential units on National Forest lands is covered by the pinyon-juniper, semi-desert shrub and grassland vegetation types on the east side of the Agua Fria River. The failure of these units to show potential water yield increase is due to one or more of the following: (1) high potential evapotranspiration and low amounts of precipitation combined with an unfavorable



monthly distribution, (2) lack of soil and rock water-storage capacity, (3) no opportunity for reducing rooting depth due to vegetative type or plant growth form, or (4) a crown density of deep rooted species of less than 30 per cent.

1.4231 Summaries by Acres of Potential Water Yield Increase Opportunities by Increased Water Yield Classes and Major Hydrologic Factors.

Summary tables have been prepared showing the acres of potential water yield increase opportunities by increased yield classes and major hydrologic factors. Increased yield classes consist of potential increased yields from 0.01 to 1.00 area inches, 1.01 to 5.00 area inches, and 5.01 plus area inches. Tables 1 through 6 summarize the basic data for a mean year only as contained in Tables 1a, 1b and 1c of Appendix III. Each Table is followed by interpretive comments and interpretation.



TABLE 1

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Source Data

| Increased<br>Yield<br>Classes | Source Area Agua Fria      |                            |                         | Total          |
|-------------------------------|----------------------------|----------------------------|-------------------------|----------------|
|                               | West Side<br>Prescott N.F. | East Side<br>Prescott N.F. | East Side<br>Tonto N.F. |                |
| (Area inches)<br>(Mean Year)  |                            | (Acres)                    |                         |                |
| No Potential                  | 24,914                     | 145,175                    | 59,988                  | 230,077        |
| 0.01 to 1.00                  | 56,950                     | 3,558                      | 1,229                   | 61,737         |
| 1.01 to 5.00                  | 73,675                     | 24,132                     | 8,115                   | 105,922        |
| 5.01 plus                     | 12,987                     | 5,184                      | 0                       | 18,171         |
| <b>TOTAL</b>                  | <b>168,526</b>             | <b>178,049</b>             | <b>69,332</b>           | <b>415,907</b> |

1. 77 percent of the opportunities to increase water yield occurs on those lands of the Prescott National Forest lying on the west side of the Agua Fria River. 60 percent of these opportunities are in the 1 inch or more potential yield class.
2. 5 percent of the opportunities to increase water yield occurs on the Tonto National Forest. 87 percent of these opportunities is in the 1-5 inch potential yield class.

Summary: The greatest opportunity for increasing water yield lies on the Prescott National Forest on the west side of the Agua Fria River. Although the Tonto National Forest offers few potential acres, the bulk of these acres show significant yield opportunities.



TABLE 2

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and vegetative Types

| Increased<br>Yield<br>Class  | Vegetative Type  |                    |           |                             | Total   |
|------------------------------|------------------|--------------------|-----------|-----------------------------|---------|
|                              | SDS              | Pinyon-<br>Juniper | Chaparral | Pond. Pine<br>Mixed Conifer |         |
| (Area Inches)<br>(Mean Year) |                  |                    | (Acres)   |                             |         |
| 0.01 to 1.00                 | 25,802 <u>1/</u> | 0                  | 35,564    | 371                         | 61,737  |
| 1.01 to 5.00                 | 0                | 0                  | 84,993    | 20,929                      | 105,922 |
| 5.01 plus                    | 0                | 0                  | 3,975     | 14,196                      | 18,171  |
| TOTAL                        | 25,802           | 0                  | 124,532   | 35,496                      | 185,830 |

1. 67 percent of the opportunities to increase water yield lie within the chaparral type.
2. 19 percent of the opportunities to increase water yield lie within the ponderosa pine-mixed conifer type.
3. In the areas showing a potential increase of over 5 area inches, 22 percent would come from the chaparral type while 78 percent would come from the ponderosa pine-mixed conifer type.

Summary: The chaparral Vegetation type offers the most opportunity for increasing water yields. The ponderosa pine-mixed conifer type offers the most opportunity in the highest potential increased yield classes.

1/ Computed increase is 0.01 area inches.



TABLE 3

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Precipitation Zones

| Increased<br>Yield<br>Class  | Precipitation Zone<br>(Inches) |        |        |        | Total   |
|------------------------------|--------------------------------|--------|--------|--------|---------|
|                              | 14                             | 18     | 22.5   | 25+    |         |
| (Area Inches)<br>(Mean Year) | (Acres)                        |        |        |        |         |
| 0.01 to 1.00                 | 11,213                         | 47,519 | 3,005  | 0      | 61,737  |
| 1.01 to 5.00                 | 486                            | 16,762 | 88,674 | 0      | 105,922 |
| 5.01 plus                    | 0                              | 0      | 6,475  | 11,696 | 18,171  |
| TOTAL                        | 11,699                         | 64,281 | 98,154 | 11,696 | 185,830 |

1. 94 percent of the opportunities to increase water yield are found in those areas which receive more than 16 inches of mean annual precipitation.
2. 87 percent of the opportunities to increase water yield are found in the precipitation zone between 16 and 25 inches of mean annual precipitation.
3. 86% of the opportunities to increase water yields in excess of 1 inch occupy areas receiving more than 20 inches of mean annual precipitation.
4. 20 or more inches of precipitation are required before potential increased water yields exceed 5 inches.

Summary: The opportunities for obtaining significant increases in water yield lie in those areas receiving 20 inches or more of mean annual precipitation.



TABLE 4

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Soil Depth Class

| Increased<br>Yield<br>Classes | Soil Depth                        |                                   | Rock<br>Land | Total   |
|-------------------------------|-----------------------------------|-----------------------------------|--------------|---------|
|                               | Shallow<br>Less Than<br>20" Depth | Deep<br>Greater Than<br>20" Depth |              |         |
| (Area Inches)                 |                                   |                                   |              |         |
| (Mean Year)                   |                                   | (Acres)                           |              |         |
| 0.01 to 1.00                  | 38,992                            | 22,745                            | 0            | 61,737  |
| 1.01 to 5.00                  | 86,929                            | 18,993                            | 0            | 105,922 |
| 5.01 plus                     | 11,988                            | 6,183                             | 0            | 18,171  |
| TOTAL                         | 137,909                           | 47,921                            |              | 185,830 |

1. 74 percent of the opportunities to increase winter yield involve shallow soils of less than 20 inches of soil depth.
2. 36 percent of the opportunities to increase water yield involve soils that are rated as having a high erosion hazard. (See Appendix II, Table 3).



TABLE 5

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Rock Type

| Increased<br>Yield<br>Classes | Rock Types         |           |        |         |         |
|-------------------------------|--------------------|-----------|--------|---------|---------|
|                               | Granite-<br>Schist | Limestone | Basalt | Aluvium | Total   |
| (Area Inches)<br>(Mean Year)  |                    |           |        |         |         |
| 0.01 to 1.00                  | 30,218             | 0         | 2,675  | 28,844  | 61,737  |
| 1.01 to 5.00                  | 95,615             | 0         | 6,637  | 3,670   | 105,922 |
| 5.01 plus                     | 15,944             | 2,227     | 0      | 0       | 18,171  |
| TOTAL                         | 141,777            | 2,227     | 9,312  | 32,514  | 185,830 |

1. 76 percent of the opportunities to increase water yield lie on soils developed from granite and schist parent rocks.
2. 87 percent of the opportunities in the 5 inches or more water yield increase class lie on soils developed from granite and schist parent rocks.

Summary: Over three-fourths of the potential water yield increase opportunities lie on soils which are comparatively low on productivity and easily eroded due to inherent characteristics of their parent rock.



TABLE 6

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Slope Range Groups

| Increased<br>Yield<br>Class  | Slope Range |                    |         | Total   |
|------------------------------|-------------|--------------------|---------|---------|
|                              | 0-30        | (Percent)<br>30-60 | 60 Plus |         |
| (Area Inches)<br>(Mean Year) |             | (Acres)            |         |         |
| 0.01 to 1.00                 | 32,748      | 28,989             | 0       | 61,737  |
| 1.01 to 5.00                 | 13,923      | 91,999             | 0       | 105,922 |
| 5.01 plus                    | 3,518       | 14,653             | 0       | 18,171  |
| TOTAL                        | 50,189      | 135,641            | 0       | 185,830 |

1. 73 percent of the opportunities to increase water yield are found on slope gradients between 30 and 60 percent.
2. 80 percent of the opportunities to increase water yield in excess of 5 inches are found on slope gradients between 30 and 60 percent.

Summary: About one-fourth of the opportunities to increase water yield is located on gentle slopes.



TABLE 7

Acres Showing Potential Water Yield Increase  
by Increased Yield Classes and Hydrologic Soil Group

| Increased<br>Yield<br>Classes | Hydrologic Soil Group |         |        | Total   |
|-------------------------------|-----------------------|---------|--------|---------|
|                               | B                     | C       | D      |         |
| (Area Inches)<br>(Mean Year)  |                       |         |        |         |
| 0.01 to 1.00                  | 0                     | 38,992  | 22,745 | 61,737  |
| 1.01 to 5.00                  | 8,686                 | 87,643  | 9,593  | 105,922 |
| 5.01 plus                     | 6,183                 | 11,988  | 0      | 18,171  |
| TOTAL                         | 14,869                | 138,623 | 32,338 | 185,830 |

1. 8 percent of the opportunities for increasing water yield are found on soils which have high infiltration and percolation rates.
2. 75 percent of the opportunities for increasing water yield are found on soils which have moderate rates of infiltration and percolation.
3. 17 percent of the opportunities for increasing water yield are found on soils which have very low rates of infiltration and percolation.

Summary: Over three-fourths of the opportunities to increase water yield are located on soils with favorable rates of infiltration and percolation.



1.4232 Potential Water Yield Increase From Alternative Prescription Combinations

Table 8 lists various prescription combinations of major hydrologic factors and expected increases in water yield. This data has been summarized from Tables 1a, 1b and 1c in Appendix III. The increased yields shown represent the maximum potential for a mean annual rainfall year on-site. The increased yields shown are for an assumed one-hundred percent conversion from deep-rooted to shallow-rooted vegetation. Such conversion would be on an entire hydrologic response unit. This theoretical conversion is also for all hydrologic response units on National Forest lands within the Agua Fria Watershed which meet the specified prescription criteria. The water yield increase quantities shown in Table 8 set the upper maximum limit for each combination of prescriptions. It is most unlikely that these amounts could be attained by conventional methods or under the principles of Multiple Use Management.



APPENDICES



## APPENDICES

- Appendix I - General Information
- Appendix II - Summary of Field Survey Data on Vegetation,  
Soils and Geology
  - Section 1 - Vegetation
  - Section 2 - Soils and Geology
- Appendix III - Water Yield Increase
- Appendix IV - Hydroclimatology
  - Section 1a - Precipitation and Climate
  - Section 1b - Snow Pack Characteristics
  - Section 2a - Runoff and Water Yield
  - Section 2b - Floods
- Appendix V - Sediment
- Appendix VI - Water Quality



APPENDIX I

GENERAL INFORMATION ON WATERSHED

# Complete Control Of Agua Fria And New River Floods In Sight

A MOVEMENT for permanent flood control works along New River, Skunk Creek and the lower Agua Fria is well off the ground and being pushed with determination.

A steering committee, a hundred or so farmers, and the citizens of towns on the west side of the Agua Fria are bent on preventing a recurrence of the disaster of last Dec. 19. (AFR, Feb. 3).

For immediate use in repairing that damage, an emergency fund of \$202,000 is available. A problem of the moment is how to expand the money so that it will fit in with an over-all plan.

At a meeting of the steering committee on Feb. 29, it was agreed that a 50-50 division between repairing or restoring property of individuals, and channel straightening or clearance would be about right. Norbert Abel, chairman of the Maricopa County Agricultural Stabilization and Conservation Service, indicated that this would be approved by his group.

Where individual aid is extended, it will cover 80% of the flood victim's expenditure. About 33 farmers have applied and several have already started work in accordance with plans arrived at with the advice of Soil Conservation Service technicians. They will receive their 80% as soon as the County ACP Committee can comply with all the legal requirements. (And most of the farmers will do considerably more work, beyond that for which they are to be partially compensated.)

## Must Be Co-Ordinated

The channel work will be a little longer getting under way, after conferences with the Corps of Engineers and Maricopa County Flood Control District. Both those agencies are likely to have much to say about any over-all program finally adopted. Care is being taken to prevent the expenditure of emergency funds on dikes or channel straightening that will not be useful when the Grand Plan is in effect.

At the Feb. 29 meeting of the New River Steering Committee, a delegation was sent to ask Col. John Lowry of the County Flood Control District to join that organization.

Glenn Smith of the New River Soil Conservation District is committee chairman and Jim Ferrin, SCS Phoenix work unit leader, has been drafted as secretary. Other members: Mayor Cecil Palmateer of Goodyear, Mayor J. D. Wagoner of Peoria, Mayor William D. Allen of Avondale, Col. S. H. Runyan of Luke Field, Keith Jensen of Peoria, Jess C. Watt of Litchfield Park. ASCS and SCS personnel participate in deliberations.

At the moment the thought is to work toward a watershed program under Public Law 566 similar to the one that has terminated the high-water menace to Safford Valley and saved that district millions of dollars.

## Speaks From Experience

Jim Ferrin was SCS leader at Safford all through the nine weary years it took to get that project under way and completed. On Feb. 29 he gave a short history of that struggle, even showing blown-up pictures of the four dams and the floodways that carry runoff harmless to the Gila. Ferrin also had pictures taken along Skunk Creek, New River and the Agua Fria last December. He didn't have to remind his audience that there have been numerous other disasters along these normally dry washes.

Ferrin also remarked that the problem is not one that affects only the farms and communities subject to flood. High water can also shut off all traffic between Phoenix and that part of the county beyond the Agua Fria, except for the Avondale bridge.

Among the benefits from a P.L. 566 program seen by the Steering Committee are these:

Farm irrigation systems can be built with the expectation that they'll last a normal length of time. Homes can be built without the constant threat of flood damage. Businesses can be established, ditto. Travel between metropolitan Phoenix and western towns will never be threatened. Sewage disposal plants will be immune to flood damage. Additional bridges across the rivers can be designed to carry a certain maximum flow, since flow will be regulated by detention dams above.

A number of suggestions have been made that may reduce the total cost of whatever program may finally be arranged. From Luke Field has come a hint that the Seabees might be induced to train in the New River area, and their training includes operation of heavy equipment as well as surveying. The mayors of Avondale and Peoria have indicated that those towns may furnish labor and facilities. The county highway dept. may make contributions. The Santa Fe and Southern Pacific railroads should be contributors since flood damage to their tracks often occurs.

— AFR —



MARICOPA COUNTY MUNICIPAL WATER  
CONSERVATION DISTRICT NUMBER ONE

| YEAR | TOTAL<br>ACRES<br>PLANTED | COTTON | CITRUS | GRAPES | FALL<br>LETTUCE | ROSES | GRAIN | SPRING<br>LETTUCE | SWEET<br>& FRESH<br>POTATOES | ALFALFA | DRY &<br>GREEN<br>ONIONS | MELONS | MISC. |
|------|---------------------------|--------|--------|--------|-----------------|-------|-------|-------------------|------------------------------|---------|--------------------------|--------|-------|
| 1957 | 23,125                    | 9,508  | 496    | 175    | 4,006           |       | 2,411 |                   | 1,007                        | 1,870   | 40                       | 733    | 2,879 |
| 1958 | 25,241                    | 10,525 | 556    | 175    | 5,162           | 60    | 2,432 |                   | 1,198                        | 2,476   | 100                      | 551    | 2,006 |
| 1959 | 25,202                    | 10,027 | 450    | 235    | 6,926           | 40    | 2,127 |                   | 475                          | 1,933   | 350                      | 555    | 2,084 |
| 1960 | 24,306                    | 10,317 | 794    | 397    | 5,396           | 165   | 631   |                   | 767                          | 1,882   | 660                      | 725    | 2,572 |
| 1961 | 22,713                    | 10,310 | 773    | 580    | 1,853           | 355   | 464   | 2,847             | 1,051                        | 100     | 567                      | 1,055  | 2,758 |
| 1962 | 22,693                    | 11,217 | 773    | 790    | 1,005           | 550   | 400   | 2,090             | 2,070                        | 90      | 890                      | 580    | 2,238 |
| 1963 | 21,404                    | 11,063 | 853    | 830    | 1,436           | 550   | 910   | 2,428             | 1,924                        | 165     | 675                      | 195    | 375   |
| 1964 | 20,256                    | 10,690 | 981    | 1,040  | 1,200           | 500   | 350   | 2,440             | 1,640                        | 160     | 630                      | 45     | 590   |
| 1965 | 20,410                    | 10,500 | 1,000  | 1,080  | 2,400           | 450   | 490   | 1,930             | 1,260                        |         | 490                      | 200    | 110   |
| 1966 | 22,580                    | 8,800  | 1,155  | 1,080  | 2,945           | 470   | 790   | 3,665             | 2,000                        | 40      | 280                      |        | 1,355 |
| 1967 | 23,609                    | 8,784  | 1,140  | 1,185  | 3,000           | 645   | 2,160 | 2,075             | 2,400                        | 40      | 650                      | 240    | 490   |

Source: H. S. Raymond, District Engineer MCHMCD #1

## MARICOPA WATER DISTRICT

MARICOPA COUNTY MUNICIPAL WATER  
CONSERVATION DISTRICT NUMBER ONEBOARD OF DIRECTORS  
SCOTT L. LIBBY, PRESIDENT  
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MARCELLA W. MARTIN, ASST. SECRETARY  
H. G. RAYMOND, DISTRICT ENGINEER  
RICHARD D. YANCY, ASST. DISTRICT ENGINEER

April 24, 1968

Mr. J. F. Arnold, Forester  
U. S. Forest Service  
Salt Verde Watershed Survey Project  
Forestry Hydrology Lab  
Arizona State University  
Tempe, Arizona 85281

Dear Joe,

For many years the Maricopa County Municipal Water Conservation District has been interested in helping to initiate a watershed program on the Agua Fria River Watershed above Lake Pleasant for the purpose of increasing water yield. As you perhaps know, the Maricopa County Municipal Water Conservation District #1 is an irrigation district formed under the laws of the State of Arizona. The District was organized as the Beardsley-Agua Fria Water Conservation District on June 13, 1925. On November 3, 1925, the name was changed to the present one.

The district consists of 33,666 acres in Maricopa County, Arizona, approximately twenty-five miles West of Phoenix. (See Exhibit 1). The district has a storage dam on the Agua Fria River about thirty-five miles Northwest of Phoenix, a diversion dam one and one-quarter miles below the storage dam, and a canal system from the diversion dam to the project lands. The capacity of Lake Pleasant, formed by Waddell Dam, is 157,000 acre feet. The lake has a surface area of 3,585 acres when full. The diversion dam has a capacity of 537 acre feet and an area of 137 acres. The main canal is thirty-three miles in length.

Prior to the construction of the project, hydrological studies on the Agua Fria River indicated sufficient runoff to justify the construction of the facilities. However, the inflow since the storage dam was completed has been inadequate. The average annual inflow since construction has been about 41,000 acre feet. (See Exhibit 2). To supplement the gravity water supply, during the period from 1939 to 1947, 120 irrigation wells were drilled on the project. The water from the wells and from storage has made it possible to farm annually about two-thirds



of the project lands. The water is of good quality and the soil is a sandy loam. Excellent crops of vegetables, citrus, melons, cotton and other crops suitable to this climate are produced in the district. (See Exhibit 3).

Because of the high rate of pumping, the water table, like similar areas in Central Arizona, has been declining about twelve feet a year. The present average lift is 525 feet. (See Exhibit 4).

The shortage of water and its high costs have caused water users in the area to develop a very high degree of water-use efficiency by adopting all feasible conservation practices. Ninety-percent of the district's distribution system is concrete lined, the remaining ten percent will be completed within the next two years. Landowners in the project have leveled their land, constructed concrete irrigation systems and, where appropriate, installed tail-water recovery systems. The re-leveling of many acres in the project is now under way in order to further improve water-use efficiency. Experimental work is being done on one field in an attempt to develop an automatic irrigation system.

The remoteness from present urban developments on the West side of Maricopa County assures this district that it will continue to be a farming area for many years if a dependable water supply can be maintained.

We would appreciate your help in establishing a watershed management program that would result in a higher water yield from the 1430 square mile drainage area above Lake Pleasant. (See Exhibit 5).

Very truly yours,

*H. S. Raymond*  
H. S. Raymond, District Engineer

HSR/mm

- Encs. - Exhibit 1 - Map of District  
Exhibit 2 - Chart of inflow - also tabulation  
Exhibit 3 - Ten year crop report  
Exhibit 4 - Chart on groundwater conditions  
Exhibit 5 - Map of watershed

Copy/Mr. Kel M. Fox

APPENDIX III

SUMMARY OF FIELD SURVEY DATA ON VEGETATION,  
SOILS AND GEOLOGY



## Section 1. Vegetation

The vegetation types range from semi-desert grassland at the lower elevations, to a woodland chaparral type at intermediate elevations, and to a mixed conifer type at the higher elevations.

Table 1-Aqua Fria Watershed (Prescott Natl. Forest)

| Type             | Crown Canopy Density Class |          |           | Type<br>Total | Acreage of Veg. Types<br>% of Total<br>Acreage |
|------------------|----------------------------|----------|-----------|---------------|------------------------------------------------|
|                  | 0-30%                      | 31-60%   | 61-100%   |               |                                                |
| Semidesert Shrub | 30,982 :                   | 31,313 : | 3,680 :   | 65,975 :      | 19%                                            |
| Chaparral        | 2,413 :                    | 12,541 : | 114,620 : | 129,574 :     | 37%                                            |
| Grassland        | 17,810 :                   | :        | :         | 17,810 :      | 5%                                             |
| Pinyon-Juniper   | 45,169 :                   | 40,801 : | 5,529 :   | 91,499 :      | 27%                                            |
| Ponderosa Pine   | :                          | 11,808 : | 29,909 :  | 41,717 :      | 12%                                            |
| Totals           | 96,374 :                   | 96,463 : | 153,738 : | 346,575 :     | 100%                                           |

Table 2-Aqua Fria Watershed (Tonto Natl. Forest)

| Type             | Crown Canopy Density Class |          |         | Type<br>Total | Acreage of Veg. Types<br>% of Total<br>Acreage |
|------------------|----------------------------|----------|---------|---------------|------------------------------------------------|
|                  | 0-30%                      | 31-60%   | 61-100% |               |                                                |
| Semidesert Shrub | 3,832 :                    | :        | :       | 3,832 :       | 5%                                             |
| Chaparral        | 29,945 :                   | 7,008 :  | 2,336 : | 39,289 :      | 57%                                            |
| Grassland        | 12,621 :                   | :        | :       | 12,621 :      | 18%                                            |
| Pinyon-Juniper   | 4,148 :                    | 9,442 :  | :       | 13,590 :      | 20%                                            |
| Totals           | 50,546 :                   | 16,450 : | 2,336 : | 69,332 :      | 100%                                           |

### Semi-desert Shrub

This vegetation type has little or no potential for water yield increase due to low precipitation and unfavorable soil moisture properties. This type contains species such as:

Snakeweed (Gutierrezia sarothrae), Creosote bush (Larrea tridentata), prickly pear (Opuntia engelmannii), Cholla (Opuntia bigelovii), cat-claw (Acacia greggii), and desert hackberry (Celtis pallida).

See Watershed Management Unit Map in text of report for general vegetation cover types and the Hydrologic Response Unit Map in the envelope inside the back cover for data on individual mapping units.

### Chaparral

The chaparral area offers the greatest opportunity for increasing water yield by vegetative conversion. The greater the crown-canopy density is, usually the greater the precipitation is, and therefore the greater the potential for increasing water yield through vegetation treatment.

The main species in the chaparral type are as follows:

Quercus turbinella (turbinella or shrub live oak)  
Arctostaphylos pringlei & A. pungens (manzanita)  
Phus ovata (mountain laurel)  
Quercus arizonica & Q-emoryi (Arizona & Emoryi Oak)  
Juniperus osteosperma (Utah juniper)  
Pinus monophylla & P. edulis (singleleaf Pinyon & Pinyon Pine)  
Rhamnus crocea (holleyleaf buckthorn)  
Carrya wrightii & C. flavescens (silk tassel)  
Ceanothus greggii & C. integrissimus (desert ceanothus and deerbrush)  
Minosa bluncifera (wait-a-bit bush)  
Cercocarpus betuloides (birchleaf mountain mahogany)

Only the two Ceanothus species have value as a browse species. Of the dominate species occurring in the Chaparral type, only Utah juniper, the two manzanitas and deerbrush do not sprout. Shrub Live Oak is a vigorous sprouter and rapidly dominates areas following fire treatment. Fire appears to scarify manzanita seeds and thus stimulates seedling production.

### Grasslands

This type occupies less than 7 percent of the watershed and offers no opportunity for increasing water yield. Some of the typical species are desert needlegrass, blue grama, side oats grama, curly mesquite, june grass, three awn and annual grama.

### Pinyon-Juniper

This type has little or no potential for increasing water yield by vegetation conversion. Pinyon and Juniper trees are considered in some locations to be invading the grassland type. Large areas of this type have been converted in the southwest in order to improve range conditions.



The species of this type are as follows:

- Alligator juniper
- One seed juniper
- Utah juniper
- Pinyon pine
- Single leaf pinyon
- Arizona cypress
- Manzanita
- Shrub live oak

#### Ponderosa Pine - Mixed Conifer

This type has a good potential for increasing water yield but also it is highly valued for its timber. The dominant species in the pine type are:

- Pinus Ponderosa (ponderosa pine)
- Pseudotsuga menziesii (Douglas-fir)
- Abies concolor (White fir), and
- Picea engelmannii (Engelman spruce)

These conifer species grow in the higher precipitation zone where 50% of the annual precipitation comes in the form of snow. The litter depths are from one to three inches which help in reducing the erosion hazard in this type. The litter depth presents a problem when reseeding to grass is attempted.

#### Section 2. Soils and Geology

Rock Types. Granite and schist are the principal rocks in the watershed. There also are sizeable areas of basalt flows. Both old and recent alluviums are present. The recent alluvial materials are on benches and flood plains of the various drainageways.

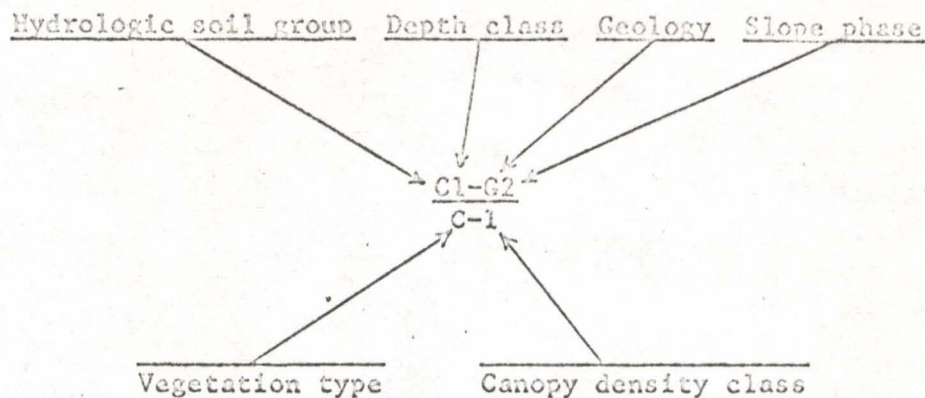
Geomorphology. Mountain masses, deep canyons, heavily dissected old alluvial fans, and mesas characterize the topography. The relief varies from very steep to gently sloping. The mountain masses generally are rugged and have steep slopes. The major deep canyons are steep walled. Situated on the basalt flows are the gently sloping nearly flat topped mesas. The old alluvial fans slope gently away from the mountain masses to the lower elevation country.

Soils. The kinds of rocks coupled with the varied topography has given rise to a number of different and distinctive soils. Those from granite and schist generally are shallow (less than 20" to rock) and are poorly developed. Those from basalt are well developed and range from shallow to deep (3' or more to rock). Many of the soils are gravelly and cobbly and some are stony. Rockland and rock outcrop are common inhabitants of the landscape. Table 2 lists the several soil mapping unit symbols and briefly presents pertinent information about the soils.

See Soil Management Report for Prescott and Granite Ranger Districts by L. D. Wheeler and J. A. Williams, March 1966.

# SOIL-VEGETATION MAPPING SYMBOL

1" to Mile - District Map



## Legend

C1-G2 = Hydrologic Soil Group, Depth Class - Geology, Slope Phase  
C-2 = Vegetation type - Canopy density class

### Hydrologic Soil Group

A - over 5.0 in/hr  
 B - 2.5 to 5.0 in/hr  
 C - 0.8 to 2.5 in/hr  
 D - less than 0.8 in/hr

### Soil Depth Class

1 - less than 20 inches  
 2 - over 20 inches  
 3 - miscellaneous materials

### Geology

A - Recent alluvium  
 AO - Old alluvium  
 B - Basalt  
 C - Cinders  
 Da - Dacite  
 Di - Diabase

G - Granite  
 LS - Limestone  
 R - Rhyolite  
 Q - Quartzite  
 S - Schist  
 SS - Sandstone

### Slope Phase

0-30 percent\*  
 2 - 30-60 percent  
 3 - 60+ percent  
 \* the number 1 is  
 not used to save  
 space on map

### Vegetation Type

C-- Chaparral  
 MC - Mixed conifer  
 SDS - Semidesert shrub  
 PP - Ponderosa pine  
 PJ - Pinyon-juniper  
 A - Aspen  
 G - Grassland  
 SF - Spruce-fir  
 R - Riparian  
 O - Oak woodland

### Crown Canopy Densities

1 - 0 to 30% class  
 2 - 31 to 60% class  
 3 - 61 to 100% class

—— Watershed Boundary

—— Annual Precipitation Isohyets

(346 Acres)



Table 3 - Soil Characteristics of Hydrologic Response Units in the Aqua Fria Watershed, Arizona

| Map<br>Symbol    | Horizon | Soil Profile                                                 | Horizon<br>Depth | Plant-             | Erosion |        | Infiltration | Productivity |
|------------------|---------|--------------------------------------------------------------|------------------|--------------------|---------|--------|--------------|--------------|
|                  |         |                                                              |                  | Available<br>Water | Index   | Hazard |              |              |
|                  |         |                                                              | In.              | In.                |         |        | iph          |              |
| B2-G )<br>B2-GS) | A       | Grayish-brown gravelly sandy<br>loam granular PH 6.5         | 0-5              | 0-8                | M       | M      | 5.0          | L            |
|                  | C       | Yellowish-brown gravelly<br>coarse sand hard, massive PH 6.0 | 5-29             | 1.7 2.5            |         |        | 6.5          |              |
|                  | R       | Granite, schist                                              | 29+              | 3.5                |         |        |              |              |
| Cl-G             | A       | Dark grayish-brown cobbly,<br>gravelly sandy loam PH 7.0     | 0-8              | 1.0                | L       | M      | 3.5          | L            |
|                  | C       | Pale brown gravelly sandy<br>loam PH 6.8                     | 8-15             | .8 1.8             |         |        | 3.5          |              |
|                  | R       | Granite                                                      | 15+              | .7                 |         |        |              |              |
| Cl-S             | A       | Dark brown gravelly loam,<br>granular to platy PH 7.0        | 0-3              | .5                 | M       | H      | 4.0          | M            |
|                  | C       | Brown gravelly loam<br>Massive PH 7.0                        | 3-6              | .5 1.0             |         |        | 2.0          |              |
|                  | R       | Schist                                                       | 6+               | .7                 |         |        |              |              |
| Cl-GS            | A       | Grayish-brown gravelly loam<br>granular PH 6.5               | 0-5              | 1.5                | M       | M      | 5.0          | M            |
|                  | C       | Yellowish-brown coarse sand<br>PH 6.0                        | 5-15             | .1 1.6             |         |        | 6.0          |              |
|                  | R       | Granite, schist                                              | 15+              | .8                 |         |        |              |              |
| Cl-LS            | A       | Dark reddish-brown silty clay<br>loam blocky PH 8.2          | 0-8              | 1.0                | ML      | M      | 2.0          | M            |
|                  | C       | Yellowish-red clay loam<br>blocky PH 8.4                     | 8-17             | 1.1 2.1            |         |        | 1.5          |              |
|                  | R       | Limestone                                                    | 17+              | .4                 |         |        |              |              |

Table 3 - Soil Characteristics of Hydrologic Response Units in the Agua Fria Watershed, Arizona

| Map<br>Symbol | Horizon        | Soil Profile                                               | Horizon<br>Depth<br>In. | Plant-<br>Available<br>Water<br>In. | Erosion |        | Infiltration<br>iph | Productivity |
|---------------|----------------|------------------------------------------------------------|-------------------------|-------------------------------------|---------|--------|---------------------|--------------|
|               |                |                                                            |                         |                                     | Index   | Hazard |                     |              |
| C1-SS         | A              | Dark brown stony loam,<br>platy PH 6.2                     | 0-3                     | .4                                  | ML      | M      | 2.0                 | M            |
|               | B              | Dark reddish-brown stony,<br>fine sandy loam PH 6.0        | 3-9                     | .8 2.2                              |         |        | 3.5                 |              |
|               | C              | Reddish-brown sandy clay<br>loam blocky PH 6.0             | 9-15                    | 1.0                                 |         |        | 2.5                 |              |
|               | R              | Sandstone                                                  | 15+                     | .5                                  |         |        |                     |              |
| B2-A0         | A              | Dark grayish-brown gravelly<br>sandy loam, platy PH 7.0    | 0-7                     | .8                                  | M       | H      | 5.0                 | M            |
|               | C              | Brown gravelly loam PH 7.2                                 | 7-35                    | 3.2                                 |         |        | 4.0                 |              |
|               | R              | Gravel                                                     | 35+                     | 8.0                                 |         |        |                     |              |
| C1-A0         | A              | Dark brown gravelly sandy loam<br>massive structure PH 7.4 | 0-3                     | .4                                  | L       | M      | 5.0                 | M            |
|               | C              | Light brownish-gray gravelly<br>sandy loam PH 7.4          | 3-18                    | 1.8                                 |         |        | 5.0                 |              |
|               | R              | Gravel                                                     | 18+                     | 3.4                                 |         |        |                     |              |
| C2-A0         | A              | Dark brown gravelly sandy loam<br>massive structure PH 7.4 | 0-3                     | 0.4                                 | L       | M      | 5.0                 | M            |
|               | C              | Light brownish-gray gravelly<br>sandy loam PH 7.4          | 3-50                    | 5.6                                 |         |        |                     |              |
|               | R              | Gravel                                                     | 50+                     | 4.0                                 |         |        |                     |              |
| D1-A0         | A              | Dark grayish-brown stony sandy<br>clay loam, platy PH 7.   | 0-7                     | .4                                  | H       | M      | 0.5                 | ML           |
|               | B              | Very dark grayish-brown gravelly<br>clay blocky PH 7.4     | 7-10                    | .5                                  |         |        |                     |              |
|               | B <sub>2</sub> | Dark reddish-brown gravelly clay<br>blocky PH 7.5          | 10-11                   | .6                                  |         |        |                     |              |
|               | C              | Dark reddish-brown gravelly clay<br>blocky PH 7.7          | 11-18                   | .6                                  |         |        |                     |              |
|               | R              |                                                            | 18+                     |                                     |         |        |                     |              |



Table 3 - Soil Characteristics of Hydrologic Response Units in the Agua Fria Watershed, Arizona

| Map<br>Symbol | Horizon         | Soil Profile                                              | Horizon<br>Depth<br>In. | Plant-<br>Available | Erosion |        | Infiltration<br>iph | Productivity |
|---------------|-----------------|-----------------------------------------------------------|-------------------------|---------------------|---------|--------|---------------------|--------------|
|               |                 |                                                           |                         | Water<br>In.        | Index   | Hazard |                     |              |
| D2-A0         | A <sub>1</sub>  | Dark grayish-brown stony sandy<br>clay loam, platy PH 7.0 | 0-5                     | .6                  | M       | M      | .6                  | ML           |
|               | A <sub>11</sub> | Very dark grayish-brown clay<br>Blocky PH 6.6             | 5-11                    | .8                  |         |        |                     |              |
|               | B               | Dark reddish-brown clay<br>Blocky PH 6.8                  | 11-20                   | 1.6                 |         |        |                     |              |
|               | C               | Dark reddish-brown clay<br>Blocky PH 7.6                  | 20-28                   | 1.4                 |         |        |                     |              |
|               | R               | Granite, schist                                           | 28+                     |                     |         |        |                     |              |
| D1-B          | A               | Reddish-brown fine sandy loam<br>blocky PH 7.8            | 0-4                     | 0.5                 | M       | ML     | 0.5                 | M            |
|               | B               | Dark red clay blocky PH 7.6                               | 4-16                    | 2.4 <sup>2.9</sup>  |         |        |                     |              |
|               | C               | Basalt                                                    | 16+                     | .2                  |         |        |                     |              |
| D2-B          | A               | Dark brownish stony clay loam<br>granular PH 7.2          | 0-4                     | .4                  | M       | ML     | .5                  | M            |
|               | B               | Dark reddish-brown clay<br>Blocky PH 7.4                  | 4-30                    | 4.7 <sup>5.1</sup>  |         |        |                     |              |
|               | C               | Basalt                                                    | 30+                     | .1                  |         |        |                     |              |
| D3-B          |                 | Basalt                                                    |                         | .1/ft               | L       | L      |                     | L            |
| D1-RL         |                 | Basalt                                                    |                         | .1/ft               | L       | L      |                     | L            |

APPENDIX III

WATER YIELD INCREASE



## POTENTIAL WATER YIELD INCREASE

Evaluation of Penman water balance equation for representative areas of the chaparral zone in the Agua Fria Watershed on National Forest land indicates that the average amount of maximum potential water yield increase is 0.15 area inches for a dry year, 0.46 area inches for an average precipitation year, and 1.12 area inches for a wet year. A dry year is considered an average of the five lowest rainfall years and a wet year is an average of the five highest rainfall years. The water increase figures are an average yield that can be expected over all the geologic and soil types in the watershed from the 31 to 100 percent crown density units. They are also based on a hundred percent conversion of chaparral to grass. These figures will vary as the aspect, slope, elevation, soil and geologic complexes change.

Failure of complete vegetative conversion will result in a water loss greater proportionately than the amount of remaining chaparral. The remaining chaparral has been growing with a moisture deficiency before conversion so will utilize the extra moisture supplied by reducing the competition.

The amount of water increase is based on an on-site water yield and is depleted by other factors as the water leaves the site. Loss of water can occur from such factors as deep seepage, evapotranspiration after it leaves the site, and stream channel storage. A considerable portion of streamflow is discharged into streambed materials either to be stored, consumed by riparian vegetation, or evaporated.

The following table gives the amount of water yield increase for each soil and vegetation type found on National Forest land within the watershed. Each area is stratified by precipitation zones, soil type, vegetation, vegetation density, depth of soil and steepness of slope. The potential increase is shown both in area inches and acre feet of water yield on each unit. This table also shows the no-potential areas.



TABLE 1a - SUMMARY OF WATER YIELD - WEST SIDE AGUA FRIA 1/

| Hydrologic<br>Map Unit<br>Symbol | Area<br>(Acres) | Present Yield<br>(Area-inches) |      |       | Future Yield<br>(Area-inches) |      |       | Maximum Potential Increase<br>(Area-inches) |      |       |             |        |        |
|----------------------------------|-----------------|--------------------------------|------|-------|-------------------------------|------|-------|---------------------------------------------|------|-------|-------------|--------|--------|
|                                  |                 | L                              | M    | H     | L                             | M    | H     | L                                           | M    | H     | (Acre-feet) |        |        |
|                                  |                 |                                |      |       |                               |      |       |                                             |      |       | L           | M      | H      |
| (1)                              | (2)             | (3)                            | (4)  | (5)   | (6)                           | (7)  | (8)   | (9)                                         | (10) | (11)  | (12)        | (13)   | (14)   |
| 14 Inch Precipitation Zone       |                 |                                |      |       |                               |      |       |                                             |      |       |             |        |        |
| A1 C1-AO/C-2&3                   | ✓7,559          | 0.46                           | 0.48 | 0.52  | 0.75                          | 0.78 | 0.83  | 0.29                                        | 0.30 | 0.31  | 181         | 189    | 196    |
| A2 C1- G/C-2&3                   | 737             | 0.67                           | 0.70 | 0.75  | 0.67                          | 0.70 | 0.81  | 0.00                                        | 0.00 | 0.06  | --          | --     | 4      |
| A3 D2- B/C-2&3                   | ✓2,675          | 0.49                           | 0.47 | 0.53  | 0.48                          | 0.51 | 1.25  | 0.04                                        | 0.04 | 0.72  | 8           | 8      | 160    |
| A4 D2- B/PJ-1&2                  | 872             | 0.44                           | 0.47 | 0.61  | 0.44                          | 0.47 | 0.61  | 0.00                                        | 0.00 | 0.00  | 0           | 0      | 0      |
| 18 Inch Precipitation Zone       |                 |                                |      |       |                               |      |       |                                             |      |       |             |        |        |
| B1 B2-AO/SDS                     | 3,580           | 0.17                           | 0.23 | 4.19  | 0.17                          | 0.23 | 4.19  | 0.00                                        | 0.00 | 0.00  | 0           | 0      | 0      |
| B2 C1-AO/C-2&3                   | ✓1,215          | 0.46                           | 0.50 | 0.57  | 1.04                          | 1.39 | 6.47  | 0.58                                        | 0.89 | 5.90  | 58          | 90     | 596    |
| B6 C1-G-S/C-2&3                  | 10,400          | 0.57                           | 0.60 | 0.75  | 0.57                          | 0.60 | 1.01  | 0.00                                        | 0.00 | 0.26  | --          | --     | 221    |
| B7 C1-G-S2/SDS                   | 25,802          | 0.21                           | 4.83 | 10.86 | 0.21                          | 4.84 | 10.87 | 0.00                                        | 0.01 | 0.01  | 0           | 26     | 26     |
| B8 C1-G-S2/C-2&3                 | 7,227           | 0.59                           | 0.68 | 0.80  | 0.59                          | 0.68 | 1.66  | 0.00                                        | 0.00 | 0.86  | --          | --     | 1,078  |
| B11 D2-AO/C-2&3                  | ✓19,273         | 0.47                           | 0.52 | 0.61  | 0.88                          | 0.94 | 1.85  | 0.41                                        | 0.42 | 1.24  | 110         | 110    | 332    |
| 22.5 Inch Precipitation Zone     |                 |                                |      |       |                               |      |       |                                             |      |       |             |        |        |
| C3 B2-G-S2/<br>PP-MC-2&3         | 8,686           | 0.38                           | 0.47 | 2.15  | 0.74                          | 3.04 | 8.01  | 0.36                                        | 2.57 | 5.86  | 260         | 1,859  | 4,239  |
| C4 C1-G/PP-MC-2&3                | 628             | 0.65                           | 0.73 | 3.99  | 0.94                          | 6.26 | 12.97 | 0.29                                        | 5.53 | 8.98  | 15          | 290    | 470    |
| C8 C1-G-S/C-2&3                  | ✓663            | 0.36                           | 0.43 | 1.23  | 0.93                          | 6.06 | 12.77 | 0.57                                        | 5.63 | 11.54 | 32          | 311    | 638    |
| C11 C1-G-S2/C-2&3                | ✓58,628         | 0.34                           | 0.38 | 0.46  | 0.89                          | 4.41 | 10.68 | 0.55                                        | 4.03 | 10.22 | 2,697       | 19,699 | 49,951 |
| C12 C1-G-S2/<br>PP-MC-2&3        | 2,746           | 0.37                           | 0.46 | 1.91  | 0.79                          | 3.33 | 9.29  | 0.42                                        | 2.87 | 7.38  | 93          | 656    | 1,689  |
| C13 C2-AO/C-2&3                  | ✓1,002          | 0.12                           | 0.17 | 2.89  | 0.18                          | 1.21 | 6.89  | 0.06                                        | 1.04 | 4.00  | 5           | 87     | 333    |
| C14 D2-AO/C-2&3                  | ✓426            | 0.46                           | 0.51 | 0.60  | 0.87                          | 0.94 | 2.11  | 0.41                                        | 0.43 | 1.51  | 14          | 14     | 53     |
| C16 D2-B/PP-MC-2&3               | 2,613           | 0.23                           | 0.29 | 3.38  | 0.30                          | 1.57 | 7.38  | 0.07                                        | 1.28 | 4.00  | 13          | 280    | 870    |
| C18 D3-RL/PP-MC-<br>2&3          | 2,098           | 5.33                           | 8.03 | 17.34 | 5.33                          | 8.03 | 17.34 | 0.00                                        | 0.00 | 0.00  | 0           | 0      | 0      |
| 25+ Inch Precipitation Zone      |                 |                                |      |       |                               |      |       |                                             |      |       |             |        |        |
| D2 B2-G-S2/PP-MC-<br>2&3         | 6,183           | 0.50                           | 1.42 | 4.68  | 1.95                          | 7.03 | 13.76 | 1.45                                        | 5.61 | 9.08  | 742         | 2,887  | 4,674  |
| D3 C1-G2/PP-MC-2&3               | 5,158           | 0.52                           | 2.11 | 5.90  | 2.28                          | 7.89 | 15.41 | 1.76                                        | 5.78 | 9.51  | 753         | 2,486  | 4,085  |
| D4 C1-G-S2/C-2&3                 | ✓355            | 0.28                           | 0.37 | 2.92  | 3.07                          | 9.56 | 17.17 | 2.79                                        | 9.19 | 14.25 | 82          | 272    | 421    |



TABLE 1b - SUMMARY OF WATER YIELD - EAST SIDE AGUA FRIA 1/

| Hydrologic<br>Map Unit<br>Symbol<br>(1) | Area<br>(Acres)<br>(2) | Present Yield<br>(Area-inches) |          |          | Future Yield<br>(Area-inches) |          |          | Maximum Potential Increase |           |           |             |           |           |
|-----------------------------------------|------------------------|--------------------------------|----------|----------|-------------------------------|----------|----------|----------------------------|-----------|-----------|-------------|-----------|-----------|
|                                         |                        |                                |          |          |                               |          |          | (Area-inches)              |           |           | (Acre-feet) |           |           |
|                                         |                        | L<br>(3)                       | M<br>(4) | H<br>(5) | L<br>(6)                      | M<br>(7) | H<br>(8) | L<br>(9)                   | M<br>(10) | H<br>(11) | L<br>(12)   | M<br>(13) | H<br>(14) |
| 14 Inch Precipitation Zone              |                        |                                |          |          |                               |          |          |                            |           |           |             |           |           |
| A3 C1-G2/C-2&3                          | ✓ 979                  | 0.46                           | 0.49     | 0.53     | 1.43                          | 1.49     | 11.86    | 0.97                       | 1.00      | 11.34     | 78          | 81        | 925       |
| A6 C2-AO/SDS                            | 9,709                  | ---                            | 0.48     | 0.52     | ---                           | 0.48     | 0.52     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A7 C2-AO/PJ-1&2                         | 3,668                  | ---                            | 0.47     | 0.51     | ---                           | 0.47     | 0.51     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A9 C2-AO2/PJ-1&2                        | 2,745                  | ---                            | 0.46     | 0.47     | ---                           | 0.46     | 0.47     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A10 C2-AO2/C-2&3                        | ✓ 486                  | 0.46                           | 0.46     | 0.46     | 2.15                          | 2.15     | 2.85     | 1.69                       | 1.69      | 2.39      | 68          | 78        | 97        |
| A15 D1-B/G                              | 4,647                  | ---                            | 1.29     | 15.36    | ---                           | 1.29     | 15.36    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A16 D1-B/PJ-1&2                         | 3,732                  | ---                            | 0.83     | 13.81    | ---                           | 0.83     | 13.81    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A17 D1-B2/PJ-1&2                        | 3,104                  | ---                            | 1.38     | 15.70    | ---                           | 1.38     | 15.70    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A20 D2-B/PJ-1&2                         | 448                    | ---                            | 1.38     | 15.70    | ---                           | 1.38     | 15.70    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| A21 D2-B/SDS                            | 11,270                 | ---                            | 0.46     | 1.33     | ---                           | 0.46     | 1.33     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| 18 Inch Precipitation Zone              |                        |                                |          |          |                               |          |          |                            |           |           |             |           |           |
| B2 C1-G/C-2&3                           | ✓ 3,424                | ---                            | 0.48     | 0.52     | ---                           | 2.49     | 7.04     | ---                        | 2.01      | 6.52      | ---         | 571       | 1,859     |
| B3 C1-G/SDS                             | 4,762                  | ---                            | 1.52     | 6.05     | ---                           | 1.52     | 6.05     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B4 C1-G2/C-2&3                          | ✓ 5,626                | ---                            | 0.46     | 0.49     | ---                           | 2.31     | 5.89     | ---                        | 1.85      | 5.40      | ---         | 866       | 2,531     |
| B5 C1-G2/SDS                            | 3,680                  | ---                            | 1.41     | 5.34     | ---                           | 1.41     | 5.34     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B8 C1-S/PP-MC-2&3                       | 4,486                  | ---                            | 0.49     | 0.53     | ---                           | 0.49     | 0.53     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B9 C1-S2/PJ-1&2                         | 3,040                  | ---                            | 2.34     | 6.14     | ---                           | 2.34     | 6.14     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B10 C1-S2/C-2&3                         | ✓ 6,938                | ---                            | 0.54     | 0.63     | ---                           | 3.24     | 7.60     | 0.00                       | 2.61      | 6.97      | ---         | 1,505     | 4,030     |
| B16 C2-AO/PJ-1&2                        | 4,467                  | ---                            | 0.49     | 0.54     | ---                           | 0.49     | 0.54     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B17 C2-G/SDS                            | 749                    | ---                            | 1.08     | 5.11     | ---                           | 1.08     | 5.11     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B20 D1-B/PJ-1&2                         | 12,819                 | ---                            | 4.93     | 11.03    | ---                           | 4.93     | 11.03    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B21 D1-B/PJ-3                           | 2,739                  | ---                            | 4.51     | 10.31    | ---                           | 4.51     | 10.31    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B22 D1-B/C-1                            | 1,146                  | ---                            | 2.18     | 6.60     | ---                           | 2.18     | 6.60     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B23 D1-B/G                              | 5,259                  | ---                            | 6.13     | 12.49    | ---                           | 6.13     | 12.49    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B25 D1-B2/PJ-3                          | 2,016                  | ---                            | 5.63     | 11.30    | ---                           | 5.63     | 11.30    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B27 D1-B2/SDS                           | 10,003                 | ---                            | 5.48     | 11.96    | ---                           | 5.48     | 11.96    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B28 D1-B2/G                             | 1,978                  | ---                            | 5.48     | 11.96    | ---                           | 5.48     | 11.96    | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B29 D1-AO2/PJ-1&2                       | 2,362                  | ---                            | 1.01     | 5.02     | ---                           | 1.01     | 5.02     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B31 D1-S2/C-2&3                         | ✓ 774                  | ---                            | 0.46     | 0.48     | ---                           | 1.60     | 4.76     | ---                        | 1.14      | 4.28      | ---         | 73        | 276       |
| B32 D2-B/PJ-1&2                         | 5,441                  | ---                            | 0.50     | 0.55     | ---                           | 0.50     | 0.55     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B34 D2-B/G                              | 2,803                  | ---                            | 0.49     | 0.54     | ---                           | 0.49     | 0.54     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B35 D2-B2/PJ-1&2                        | 1,798                  | ---                            | 0.52     | 1.09     | ---                           | 0.52     | 1.09     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |
| B36 D3-B2/PJ-1&2                        | 3,552                  | ---                            | 0.54     | 1.54     | ---                           | 0.54     | 1.54     | 0.00                       | 0.00      | 0.00      | 0           | 0         | 0         |

1/ National Forest Watershed - Prescott No. 7; National Forest Watershed - Tonto No. 1



TABLE 1b - SUMMARY OF WATER YIELD - EAST SIDE AGUA FRIA (Cont.)

| Hydrologic<br>Map Unit<br>Symbol | Area<br>(Acres) | Present Yield<br>(Area-inches) |       |       | Future Yield<br>(Area-inches) |       |       | Maximum Potential Increase |      |       |             |       |       |
|----------------------------------|-----------------|--------------------------------|-------|-------|-------------------------------|-------|-------|----------------------------|------|-------|-------------|-------|-------|
|                                  |                 |                                |       |       |                               |       |       | (Area-inches)              |      |       | (Acre-feet) |       |       |
|                                  |                 | L                              | M     | H     | L                             | M     | H     | L                          | M    | H     | L           | M     | H     |
| (1)                              | (2)             | (3)                            | (4)   | (5)   | (6)                           | (7)   | (8)   | (9)                        | (10) | (11)  | (12)        | (13)  | (14)  |
| 22.5 Inch Precipitation Zone     |                 |                                |       |       |                               |       |       |                            |      |       |             |       |       |
| C1 C1-G2/C-1                     | ✓1,267          | ---                            | 5.90  | 12.46 | ---                           | 5.90  | 12.46 | 0.00                       | 0.00 | 0.00  | 0           | 0     | 0     |
| C2 C1-G2/C-2&3                   | ✓2,957          | ---                            | 0.52  | 0.59  | ---                           | 6.98  | 14.02 | ---                        | 6.46 | 13.42 | ---         | 1,600 | 3,312 |
| C3 C1-LS/PP-MC-2&3               | 2,227           | ---                            | 0.51  | 2.78  | ---                           | 6.26  | 13.20 | ---                        | 5.75 | 10.42 | ---         | 1,067 | 1,933 |
| C6 C1-S/PP-MC-2&3                | 678             | ---                            | 0.51  | 0.88  | ---                           | 5.40  | 12.04 | ---                        | 4.89 | 11.16 | ---         | 276   | 630   |
| C7 C1-S2/PJ-1&2                  | 954             | ---                            | 4.47  | 10.72 | ---                           | 4.47  | 10.72 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C8 C2-AO/PJ-1&2                  | 947             | ---                            | 0.61  | 3.94  | ---                           | 0.61  | 3.94  | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C9 D1-B/G                        | 1,779           | ---                            | 11.04 | 19.99 | ---                           | 11.04 | 19.99 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C10 D1-B/PJ-1&2                  | 3,077           | ---                            | 10.21 | 18.78 | ---                           | 10.21 | 18.78 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C11 D1-B2/G                      | 3,174           | ---                            | 11.04 | 19.99 | ---                           | 11.04 | 19.99 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C13 D1-RL3/PP-MC-2&3             | 461             | ---                            | 2.22  | 6.53  | ---                           | 2.22  | 6.53  | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C14 D2-AO/PP-MC-2&3              | 371             | ---                            | 0.51  | 0.72  | ---                           | 1.49  | 5.22  | ---                        | 0.18 | 4.50  | ---         | 5     | 139   |
| C15 D2-AO-B/PP-MC-2&3            | 2,182           | ---                            | 0.51  | 0.68  | ---                           | 1.57  | 5.29  | ---                        | 1.06 | 4.61  | ---         | 192   | 838   |
| C16 D2-B/PJ-1&2                  | 6,892           | ---                            | 1.15  | 4.51  | ---                           | 1.15  | 4.51  | ---                        | 0.00 | 0.00  |             |       |       |
| C17 D2-B2/PP-MC-2&3              | 826             | ---                            | 0.50  | 0.55  | ---                           | 0.50  | 0.55  | ---                        | 0.00 | 0.00  |             |       |       |
| C18 D3-B2/PJ-1&2                 | 18,516          | ---                            | 0.55  | 2.47  | ---                           | 0.55  | 2.47  | ---                        | 0.00 | 0.00  |             |       |       |
| C19 D3-B3/C-2&3                  | 845             | ---                            | 0.53  | 2.22  | ---                           | 0.53  | 2.22  | ---                        | 0.00 | 0.00  |             |       |       |
| C20 C1-G2/C-2&3                  | ✓2,208          | ---                            | 0.06  | 0.14  | ---                           | 0.43  | 1.52  | ---                        | 0.37 | 1.38  | ---         | 68    | 253   |
| C22 D1-B/PJ-1&2                  | 410             | ---                            | 6.21  | 19.88 | ---                           | 6.21  | 19.88 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C23 D1-B2/PJ-1&2                 | 1,690           | ---                            | 6.21  | 19.88 | ---                           | 6.21  | 19.88 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| C24 D3-B2/PJ-1&2                 | 211             | ---                            | 0.14  | 10.50 | ---                           | 0.14  | 10.50 | ---                        | 0.00 | 0.00  | 0           | 0     | 0     |
| 25+ Inch Precipitation Zone      |                 |                                |       |       |                               |       |       |                            |      |       |             |       |       |
| D1 D1-B2/PJ-1&2                  | 1,069           | ---                            | 16.43 | 27.04 | ---                           | 16.43 | 27.04 | 0.00                       | 0.00 | 0.00  | 0           | 0     | 0     |
| D2 D2-B/PP-MC-2&3                | 4,024           | ---                            | 4.88  | 6.86  | ---                           | 6.12  | 11.14 | ---                        | 1.24 | 4.28  | ---         | 414   | 1,136 |
| D4 D1-B2/PJ-1&2                  | 755             | ---                            | 12.43 | 23.04 | ---                           | 12.43 | 23.04 | 0.00                       | 0.00 | 0.00  | 0           | 0     | 0     |
| D5 D3-SS2/C-2&3                  | 3,181           | ---                            | 0.11  | 0.19  | ---                           | 0.11  | 0.19  | 0.00                       | 0.00 | 0.00  | 0           | 0     | 0     |

TABLE 1c - SUMMARY OF WATER YIELD - TONTO NATIONAL FOREST \*

|                              |        |      |      |      |      |      |       |      |      |       |     |       |     |
|------------------------------|--------|------|------|------|------|------|-------|------|------|-------|-----|-------|-----|
| 18 Inch Precipitation Zone   |        |      |      |      |      |      |       |      |      |       |     |       |     |
| B2 C1-G/C-PJ-2               | ✓1,229 | 0.42 | 0.48 | 0.52 | 0.74 | 0.92 | 1.39  | 0.32 | 0.44 | 0.87  | --- | 46    | --- |
| 22.5 Inch Precipitation Zone |        |      |      |      |      |      |       |      |      |       |     |       |     |
| C3 C1-G2/C-2                 | ✓8,115 | 0.48 | 0.52 | 0.59 | 1.49 | 4.75 | 10.82 | 1.01 | 4.23 | 10.23 | --- | 2,860 | --- |

\* Only two units on the Tonto National Forest within the Agua Fria Watershed show potential water yield increase - the units without potential are not shown.



TABLE 1 - Sample Calculations of Increased Water Yields  
from Converting Chaparral to Grass. 1/

Aspect W  
Slope 12%  
AWHC(A) 1.5 in.  
(B) 13.0 in.

EVAPOTRANSPIRATION COMPUTATION FORM

|                                  |       |                                 |      |      |       |       |                                                |               |       |                 |      |      |      |       |  |  |
|----------------------------------|-------|---------------------------------|------|------|-------|-------|------------------------------------------------|---------------|-------|-----------------|------|------|------|-------|--|--|
| Watershed                        |       | Mazatzal Hydrologic Subprovince |      |      |       |       | Subwatershed Mine-Boulder Mtn. Conversion Area |               |       |                 |      |      |      |       |  |  |
| Forest                           | Tonto | District                        |      |      |       |       | Date                                           | February 1967 |       | Name H. D. Kent |      |      |      |       |  |  |
| "AVERAGE MONTHLY YEAR"           |       |                                 |      |      |       |       |                                                |               |       |                 |      |      |      |       |  |  |
|                                  | No.   | J                               | F    | M    | A     | M     | J                                              | J             | A     | B               | O    | N    | D    | Year  |  |  |
| Temperature                      | 1     | 30.7                            | 41.5 | 45.0 | 53.0  | 50.6  | 60.7                                           | 75.0          | 73.6  | 67.7            | 51.1 | 45.7 | 41.7 |       |  |  |
| Heat Index                       | 2     | .63                             | 1.07 | 1.91 | 3.60  | 5.76  | 8.41                                           | 10.84         | 10.15 | 8.06            | 4.70 | 1.87 | .24  | 50.25 |  |  |
| Unadjusted PE                    | 3     | 0.31                            | 0.56 | 0.93 | 1.80  | 2.77  | 3.60                                           | 4.76          | 4.63  | 3.60            | 2.17 | 0.90 | 0.62 |       |  |  |
| Correction Factor                |       | 1.00                            | 1.00 | 1.00 | 1.00  | 1.00  | 1.00                                           | 1.00          | 0.99  | 1.00            | 1.00 | 1.00 | 1.00 |       |  |  |
| Adjusted PE                      | 4     | 0.31                            | 0.56 | 0.93 | 1.80  | 2.77  | 3.60                                           | 4.76          | 4.60  | 3.60            | 2.17 | 0.90 | 0.62 | 26.61 |  |  |
| Precipitation                    | 5     | 2.91                            | 2.58 | 2.76 | 0.72  | 0.54  | 0.53                                           | 2.58          | 2.57  | 2.05            | 2.24 | 1.67 | 2.30 | 19.77 |  |  |
| Precipitation-PE                 | 6     | 2.60                            | 1.82 | 1.83 | -1.01 | -2.45 | -3.32                                          | -2.59         | -1.03 | -1.55           | 0.07 | 0.77 | 1.69 | 11.11 |  |  |
| Accumulated Potential Water Loss | 7     |                                 |      | 0    | -1.01 | -2.45 | -3.32                                          | -2.59         | -1.03 | -1.55           | 0.07 | 0.77 | 1.69 |       |  |  |
| Storage                          | 8     | 1.50                            | 1.50 | 1.50 | 0.49  | 0.13  | 0                                              | 0             | 0     | 0               | 0.07 | 0.84 | 1.50 |       |  |  |
| After Before                     |       | 0.35                            | 1.17 | 1.30 | 1.02  | 0.26  | 2.18                                           | 6.58          | 5.87  | 5.23            | 5.50 | 6.07 | 7.25 |       |  |  |
| Δ Storage                        | 9     | 0                               | 0    | 0    | -0.77 | -0.60 | -0.13                                          | 0             | 0     | 0               | 0.07 | 0.11 | 0.65 |       |  |  |
| Actual                           | 10    | 0.31                            | 0.56 | 0.93 | 1.56  | 0.91  | 0.51                                           | 2.58          | 3.51  | 2.05            | 2.17 | 0.90 | 0.62 | 16.50 |  |  |
| Evapotranspiration               |       | 0.31                            | 0.56 | 0.93 | 1.77  | 2.59  | 2.58                                           | 2.18          | 2.06  | 1.71            | 2.17 | 0.90 | 0.62 | 23.71 |  |  |
| Moisture Deficit                 | 11    | 0                               | 0    | 0    | 0.24  | 1.65  | 2.07                                           | 2.56          | 1.03  | 1.55            | 0    | 0    | 0    | 13.54 |  |  |
|                                  |       | 0                               | 0    | 0    | 0.03  | 0.37  | 1.04                                           | 1.18          | 0.54  | 0.87            | 0    | 0    | 0    | 4.47  |  |  |
| Moisture Surplus                 | 12    | 2.60                            | 1.82 | 1.83 |       |       |                                                |               |       |                 |      |      | 1.02 | 2.27  |  |  |
|                                  |       |                                 |      | 1.00 |       |       |                                                |               |       |                 |      |      |      | 1.00  |  |  |
| Water Runoff                     | 13    |                                 |      |      |       |       |                                                |               |       |                 |      |      |      |       |  |  |

BEFORE CONVERSION

|                                  |    |      |      |      |       |       |       |       |       |       |      |      |      |       |  |
|----------------------------------|----|------|------|------|-------|-------|-------|-------|-------|-------|------|------|------|-------|--|
| Adjusted PE                      | 4  | 0.31 | 0.56 | 0.93 | 1.80  | 2.77  | 3.60  | 4.76  | 4.60  | 3.60  | 2.17 | 0.90 | 0.62 | 26.61 |  |
| Precipitation                    | 5  | 2.91 | 2.58 | 2.76 | 0.72  | 0.54  | 0.53  | 2.58  | 2.57  | 2.05  | 2.24 | 1.67 | 2.30 | 19.77 |  |
| Precipitation-PE                 | 6  | 2.60 | 1.82 | 1.83 | -1.01 | -2.45 | -3.32 | -2.59 | -1.03 | -1.55 | 0.07 | 0.77 | 1.69 | 11.11 |  |
| Accumulated Potential Water Loss | 7  |      |      | 0    | -1.01 | -2.45 | -3.32 | -2.59 | -1.03 | -1.55 | 0.07 | 0.77 | 1.69 |       |  |
| Storage                          | 8  | 1.50 | 1.50 | 1.50 | 0.49  | 0.13  | 0     | 0     | 0     | 0.07  | 0.84 | 1.50 |      |       |  |
| Δ Storage                        | 9  | 0    | 0    | 0    | -0.77 | -0.60 | -0.13 | 0     | 0     | 0     | 0.07 | 0.11 | 0.65 |       |  |
| Actual Evapotranspiration        | 10 | 0.31 | 0.56 | 0.93 | 1.56  | 0.91  | 0.51  | 2.58  | 3.51  | 2.05  | 2.17 | 0.90 | 0.62 | 16.50 |  |
| Moisture Deficit                 | 11 | 0    | 0    | 0    | 0.24  | 1.65  | 2.07  | 2.56  | 1.03  | 1.55  | 0    | 0    | 0    | 13.54 |  |
| Moisture Surplus                 | 12 | 2.60 | 1.82 | 1.83 |       |       |       |       |       |       |      |      |      | 1.02  |  |
| Water Runoff                     | 13 |      |      |      |       |       |       |       |       |       |      |      |      | 1.00  |  |

AFTER CONVERSION

|                                  |    |      |      |       |       |       |       |       |       |       |       |       |       |      |      |
|----------------------------------|----|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|
| Accumulated Potential Water Loss | 7  |      |      | -0.20 | -1.17 | -1.13 | -2.07 | -2.25 | -1.20 | -1.50 | -1.50 | -1.50 | -1.50 |      |      |
| Storage                          | 8  | 1.50 | 1.50 | 1.29  | 0.45  | 0.01  | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 1.50 | 1.50 |
| Δ Storage                        | 9  | 0    | 0    | -0.21 | -0.45 | -0.46 | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0    | 0    |
| Actual Evapotranspiration        | 10 |      |      |       |       |       |       |       |       |       |       |       |       |      |      |
| Moisture Deficit                 | 11 |      |      |       |       |       |       |       |       |       |       |       |       |      |      |
| Moisture Surplus                 | 12 | 1.48 | 1.54 |       |       |       |       |       |       |       |       |       |       | 2.52 |      |
| Water Runoff                     | 13 | 6.70 | 2.62 |       |       |       |       |       |       |       |       |       |       | 2.25 | 2.12 |

1/ This data is shown graphically in Exhibit 6 in the body of the report.



# CHAPARRAL

## Precipitation-Streamflow for 3-Bar Watersheds C and D<sup>1/</sup>

| Year <sup>2/</sup>             | Precipitation | Runoff           | Percent of    |       |             |
|--------------------------------|---------------|------------------|---------------|-------|-------------|
| Winter <sup>3/</sup>           | Annual        | Area             | Precipitation |       |             |
| -----inches-----               |               | -----inches----- |               |       |             |
| Watershed C - 3,200-5,200 feet |               |                  |               |       |             |
| Prefire                        | 1956-57       | 22.14            | 25.64         | 1.41  | 5.5         |
|                                | 57-58         | 18.99            | 21.72         | .85   | 3.9         |
|                                | 58-59         | 8.91             | 16.46         | .01   | 0.1         |
|                                | Average       | 16.68            | 21.27         | .76   | 3.2 (3.6)   |
| Post-fire                      | 1959-60       | 24.74            | 33.87         | 11.43 | 33.7        |
| (shrubs -                      | 60-61         | 10.29            | 14.62         | 1.51  | 10.3        |
| suppressed)                    | 61-62         | 19.93            | 26.02         | 6.45  | 24.8        |
| "                              | 62-63         | 14.74            | 17.70         | 4.01  | 22.7        |
|                                | 63-64         | 12.03            | 20.26         | 3.30  | 16.3        |
|                                | 64-65         | 23.17            | 36.15         | 12.00 | 33.0        |
|                                | Average       | 17.49            | 24.77         | 6.45  | 23.4 (26.1) |
| Watershed D - 3,700-5,290 feet |               |                  |               |       |             |
| Prefire                        | 1956-57       | 25.62            | 29.75         | 1.54  | 5.2         |
|                                | 57-58         | 25.66            | 29.37         | .96   | 3.3         |
|                                | 58-59         | 11.05            | 20.00         | .30   | 1.5         |
|                                | Average       | 20.78            | 26.37         | .93   | 3.3 (3.5)   |
| Post-fire                      | 1959-60       | 28.42            | 39.43         | 11.18 | 28.6        |
| (shrubs                        | 60-61         | 12.82            | 18.38         | 1.47  | 8.0         |
| allowed to                     | 61-62         | 24.27            | 32.15         | 3.11  | 9.7         |
| grow)                          | 62-63         | 17.90            | 21.38         | 1.14  | 5.3         |
|                                | 63-64         | 14.43            | 23.50         | .58   | 2.5         |
|                                | 64-65         | 23.57            | 37.26         | 2.25  | 6.0         |
|                                | Average       | 20.23            | 28.68         | 3.29  | 10.0 (11.5) |

<sup>1/</sup> Records from Rocky Mountain Forest and Range Expt. Sta.

<sup>2/</sup> Year starts July 1st.

<sup>3/</sup> Winter period is October 1 through June 30.

Joseph F. Arnold

1/17/67



# CHAPARRAL

## PRECIPITATION AND RUNOFF FOR PARKER CREEK ARRANGED BY

### ANNUAL PRECIPITATION CLASSES\*

| No. Water : |               | Annual Precipitation : |             | Runoff             |  |
|-------------|---------------|------------------------|-------------|--------------------|--|
| Years :     | Class Range : | Average :              | Area :      | % of Annual        |  |
| 10/1-9/30 : | (inches)      | (inches)               | Inches :    | Precipitation      |  |
| (700 acres) |               | (Chaparral)            |             | (5,450-7,583 feet) |  |
| 5           | 14.8-18.8     | 17.0                   | 2.0         | 12.7               |  |
| 4           | 21.3-23.9     | 22.9                   | 2.6         | 11.2               |  |
| 5           | 24.2-26.2     | 25.2                   | 5.4         | 21.0               |  |
| 5           | 27.7-29.4     | 28.4                   | 6.8         | 23.9               |  |
| 2           | 30.7-32.0     | 31.4                   | 7.8         | 24.6               |  |
| <u>1</u>    | 45.2          | <u>45.2</u>            | <u>21.6</u> | <u>47.6</u>        |  |
| 22          |               | 25.1                   | 5.4         | 20. (22)           |  |

\*Data from Rocky Mountain Forest and Range Experiment Station.

Precipitation from Sierra Ancha headquarters.

J. F. Arnold  
10/11/66

APPENDIX IV  
HYDROCLIMATOLOGY



## APPENDIX IV

### HYDROCLIMATOLOGY

#### Section 1a - Precipitation and Climate

The Agua Fria Watershed ranges in elevation from 7,700 feet at Mount Union to 1,600 feet at Lake Carl Pleasant. Precipitation varies from 26 annual inches at Crown King to 12 annual inches at Prescott Airport and from 17 annual inches at Jerome to 13 annual inches at Cordes. The watershed is located in an area of well defined wet and dry periods.

The summer thunderstorm season from July to mid-September brings nearly half of the year's rainfall. In this season thunderstorms occur on an average of every other day, with an average thunderstorm day of .15 inch of rain. These summer thunderstorms at times cause flash floods that do some local damage along the main channel. The mean annual flood near Mayer, Arizona is 5800 c.f.s. These floods are not extensive or of long duration. The largest flood on record in the Agua Fria below Mayer occurred in March, 1941 with a discharge of 13,000 c.f.s.

Climatic data used in preparing water surplus predictions for the watershed were taken from elevation-precipitation and elevation-temperature relationships derived from the climatic records of the U. S. Weather Bureau and Rocky Mountain Forest and Range Experiment Station records.

## TOTAL PRECIPITATION (INCHES) FOR PRFSCOTT, ARIZONA

| Year | Jan. | Feb.  | Mar. | Apr. | May            | June                                  | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|------|------|-------|------|------|----------------|---------------------------------------|------|------|------|------|------|------|--------|
| 1898 |      |       |      |      | 0.92           | 0.88                                  | 2.04 | 3.53 | 0.00 | 0.00 | 0.68 | 1.25 |        |
| 1899 | 0.97 | 0.66  | 0.30 | T    | 0.02           | 1.65                                  | 3.03 | 0.89 | 0.00 | 1.34 | 1.43 | 0.60 | 10.91  |
| 1900 | 0.88 | T     | 0.74 | 2.67 | 0.78           | T                                     | 0.45 | 1.70 | 0.14 | 0.62 | 2.35 | 0.00 | 10.33  |
| 1901 | 1.10 | 2.52  | 0.72 | 0.03 | 1.18           | 0.00                                  | 3.70 | 1.39 | 0.00 | 0.73 | 1.40 | 0.00 | 12.77  |
| 1902 | 2.00 | 0.65  | 1.73 | 0.50 | T              | 0.00                                  | 0.28 | 4.64 | 1.59 | 0.00 | 2.80 | 0.12 | 14.31  |
| 1903 | 0.74 | 1.40  | 3.18 | T    | 0.96           | 3.13                                  | 3.81 | 2.36 | 0.10 | 0.00 | 0.00 | 0.00 | 16.74  |
| 1904 | 0.35 | 0.50  | 1.00 | 0.93 | 0.70           | 0.00                                  | 4.57 | 6.74 |      |      | 0.00 | 0.40 |        |
| 1905 | 4.74 | 7.92  | 6.17 | 3.81 | 0.88           | 0.00                                  | 0.11 | 3.78 | 1.73 | 0.12 | 8.68 | 1.53 | 39.47  |
| 1906 | 0.50 | 0.13  | 5.71 | 1.10 | 0.14           | T                                     | 4.21 | 5.28 | 0.07 | 0.48 | 2.90 | 3.61 | 24.13  |
| 1907 | 3.06 |       |      |      | 0.35           |                                       |      |      |      |      |      |      |        |
| 1908 |      |       |      |      |                | T                                     | 8.80 | 2.35 | 1.00 | 1.11 | 0.41 | 5.69 |        |
| 1909 | 2.11 | 2.93  | 1.71 | 0.13 | T              | 0.23                                  | 5.25 | 4.01 | 2.20 | 0.00 | 0.96 | 2.28 | 21.81  |
| 1910 | 1.86 | 0.28  | 1.18 | 0.45 | 0.00           | 1.05                                  | 1.89 | 2.03 | 0.13 | 1.19 | 2.23 | 1.00 | 13.29  |
| 1911 | 5.67 | 1.81  | 2.33 | 0.07 | T              | 0.30                                  | 4.76 | 2.78 | 2.02 | 2.62 | 0.00 | 0.23 | 22.59  |
| 1912 | T    | T     | 6.04 | 2.26 | 0.69           | 0.80                                  | 6.19 | 2.21 | 0.30 | 4.22 | 0.03 | 1.23 | 23.97  |
| 1913 | 0.37 | 2.99  | 0.17 | 0.08 | T              | T                                     | 3.27 | 2.50 | 2.64 | 0.25 | 1.23 | 0.43 | 13.93  |
| 1914 | 1.92 | 2.14  | 0.37 | 0.36 | 0.15           | 0.33                                  | 2.12 | 2.10 | 2.36 | 2.36 | 0.46 | 2.45 | 17.12  |
| 1915 | 3.11 | 2.32  | 1.12 | 2.04 | 0.99           | 0.16                                  | 2.31 | 1.51 | 0.56 | 0.13 | 1.24 | 4.46 | 19.95  |
| 1916 | 7.79 | 0.48  | 2.47 | 0.33 | 0.06           | 0.00                                  | 2.24 | 2.60 | 1.83 | 3.30 | 0.00 | 0.93 | 22.03  |
| 1917 | 2.76 | 1.49  | 0.22 | 5.43 | 1.22           | 0.00                                  | 2.69 | 1.57 | 1.24 | 0.03 | T    | 0.00 | 16.65  |
| 1918 | 2.55 | 2.17  | 7.11 | 0.04 | 0.00           | 2.13                                  | 2.57 | 2.24 | 0.35 | 0.42 | 1.55 | 0.95 | 22.08  |
| 1919 | T    | 3.39  | 1.03 | 0.82 | 1.72           | T                                     | 4.53 | 4.75 | 3.27 | 3.44 | 5.41 | 0.45 | 28.81  |
| 1920 | 1.95 | 7.32  | 2.73 | 0.07 | 0.80           | 0.15                                  | 1.92 | 1.97 | 1.80 | 2.37 | 0.35 | 0.61 | 22.04  |
| 1921 | 1.45 | 0.59  | 1.20 | 1.06 | 1.47           | 0.18                                  | 4.71 | 2.72 | 1.20 | 0.64 | 0.65 | 5.29 | 21.16  |
| 1922 | 5.51 | 1.65  | 2.96 | 0.75 | 1.35           | 0.24                                  | 1.48 | 3.56 | 2.50 | 0.78 | 2.50 | 1.48 | 24.76  |
| 1923 | 1.94 | 0.83  | 1.89 | 0.37 | 0.11           | T                                     | 3.28 | 4.35 | 3.36 | 0.30 | 2.15 | 5.42 | 26.00  |
| 1924 | 0.27 | T     | 2.84 | 1.35 | 0.00           | 0.52                                  | 1.82 | 1.55 | 2.45 | 0.88 | 0.45 | 4.13 | 16.26  |
| 1925 | 0.20 | 0.62  | 0.94 | 2.00 | 0.02           | 1.05                                  | 3.32 | 4.62 | 3.79 | 2.95 | 1.45 | 0.61 | 21.57  |
| 1926 | 0.87 | 0.56  | 1.93 | 6.90 | 0.58           | 0.24                                  | 3.32 | 2.34 | 1.26 | 0.48 | 0.90 | 4.80 | 24.18  |
| 1927 | 1.33 | 10.59 | 1.88 | 1.08 | 0.22           | 0.61                                  | 2.48 | 6.10 | 4.87 | 1.13 | 1.00 | 2.68 | 33.97  |
| 1928 | 0.79 | 2.34  | 0.70 | 0.31 | 0.43           | 0.00                                  | 0.48 | 1.53 | 0.93 | 2.05 | 1.57 | 2.65 | 13.78  |
| 1929 | 1.81 | 1.74  | 1.58 | 1.06 | 0.10           | 0.00                                  | 2.61 | 4.14 | 2.66 | 0.05 | 0.13 | 0.00 | 15.88  |
| 1930 | 5.25 | 1.06  | 3.02 | 1.49 | 1.52           | 0.08                                  | 5.24 | 3.16 | 2.03 | 0.54 | 2.86 | T    | 26.25  |
| 1931 | 0.19 | 4.19  | 0.20 | 0.80 | 0.38           | 0.62                                  | 5.99 | 4.26 | 1.05 | 1.32 | 2.34 | 3.22 | 24.56  |
| 1932 | 1.44 | 7.17  | 0.47 | 0.85 | 0.24           | 1.66                                  | 2.91 | 2.89 | 1.06 | 0.79 | 0.00 | 3.26 | 22.54  |
| 1933 | 3.43 | 0.20  | 0.00 | 1.02 | 0.61           | 0.15                                  | 2.49 | 2.51 | 3.25 | 0.89 | 2.12 | 0.64 | 17.31  |
| 1934 | 0.72 | 0.99  | 0.25 | 1.23 | 1.65           | 0.15                                  | 0.63 | 8.70 | 0.18 | 0.00 | 1.17 | 1.84 | 17.51  |
| 1935 | 3.66 | 3.31  | 2.46 | 1.41 | 0.13           | 0.00                                  | 2.37 | 6.56 | 2.39 | 0.00 | 0.76 | 0.47 | 23.52  |
| 1936 | 0.52 | 3.50  | 2.21 | 0.21 | 0.00           | 0.35                                  | 1.96 | 2.26 | 2.28 | 2.47 | 0.87 | 2.86 | 19.49  |
| 1937 | 3.88 | 5.92  | 2.82 | 0.19 | 0.41           | 0.74                                  | 1.49 | 2.28 | 1.44 | 0.00 | 0.15 | 1.99 | 21.31  |
| 1938 | 1.46 | 3.51  | 4.87 | 0.09 | 0.07           | 0.84                                  | 3.03 | 4.20 | 1.29 | 0.13 | 0.01 | 3.51 | 23.01  |
| 1939 | 1.57 | 1.31  | 1.24 | 0.42 | 0.01           | T                                     | 1.50 | 4.29 | 4.05 | T    | 1.17 | 0.43 | 15.99  |
| 1940 | 1.07 | 2.69  | 0.25 | 1.78 | 0.82           | 0.78                                  | 0.41 | 1.83 | 3.35 | 3.47 | 1.27 | 4.59 | 22.31  |
| 1941 | 2.29 | 2.87  | 3.10 | 4.53 | 0.39           | 0.05                                  | 1.32 | 3.23 | 2.66 | 2.69 | 1.13 | 1.56 | 25.92  |
| 1942 | 0.53 | 1.04  | 0.44 | 1.36 | 0.00           | 0.00                                  | 2.25 |      |      |      |      |      |        |
| 1943 |      |       |      |      |                | station closed, Aug. 1942 - June 1944 |      |      |      |      |      |      |        |
| 1944 |      |       |      |      |                | 1.08                                  | 0.30 | 1.76 | 0.38 | 1.37 | 0.91 |      | 11.28  |
| 1945 |      | 0.76  | 2.92 | 0.00 | station closed |                                       |      |      | 0.10 | 0.81 | T    | 3.55 |        |
| 1946 | 0.98 | 0.51  | 0.49 | 2.75 | 0.14           | 0.00                                  | 5.03 | 5.78 | 2.04 | 0.88 | 2.51 | 1.57 | 22.68  |
| 1947 | 0.21 | 0.14  | 0.49 | 0.04 | 0.80           | 0.02                                  | 2.00 | 2.54 | 0.81 | 0.48 | 0.92 | 2.54 | 10.99  |
| 1948 | 0.04 | 1.75  | 1.44 | 0.07 | T              | 0.30                                  | 1.84 | 3.04 | 0.08 | 1.27 | T    | 3.26 | 13.09  |
| 1949 | 6.53 | 0.88  | 0.55 | 0.32 | 0.12           | 0.70                                  | 2.80 | 0.75 | 1.28 | 2.12 | 0.84 | 1.88 | 18.77  |
| 1950 | 0.63 | 0.79  | 0.64 | 0.11 | 0.28           | T                                     | 5.39 | 2.02 | 1.30 | 0.34 | 0.15 | T    | 11.65  |
| 1951 | 2.08 | 0.90  | 0.49 | 1.71 | 0.81           | 0.00                                  | 3.26 | 5.34 | 0.11 | 1.54 | 1.11 | 4.86 | 22.21  |
| 1952 | 2.32 | 0.39  | 3.55 | 1.75 | T              | 0.17                                  | 3.35 | 2.98 | 1.77 | 0.00 | 2.20 | 1.09 | 19.57  |
| 1953 | 0.35 | 0.43  | 0.54 | 0.65 | 0.27           | T                                     | 7.46 | 5.28 | T    | 0.06 | 1.29 | 0.32 | 16.65  |
| 1954 | 2.40 | 1.41  | 3.45 | 0.07 | 0.55           | 1.55                                  | 3.06 | 2.01 | 1.29 | 0.30 | 0.32 | 0.50 | 16.91  |
| 1955 | 1.96 | 0.42  | 0.09 | 0.33 | 0.11           | 1.83                                  | 5.03 | 5.02 | 0.02 | 0.60 | 1.25 | 1.16 | 17.82  |
| 1956 | 0.44 | 0.33  | T    | 0.35 | T              | 0.42                                  | 2.80 | 0.95 | 0.34 | 1.01 | 0.00 | 0.24 | 6.88   |
| 1957 | 7.55 | 0.97  | 0.63 | 0.63 | 1.12           | 0.67                                  | 0.96 | 3.31 | 0.04 | 3.24 | 2.78 | 1.03 | 22.93  |
| 1958 | 0.17 | 3.51  | 2.42 | 1.68 | 0.59           | 1.06                                  | 3.01 | 4.77 | 4.91 | 1.66 | 0.70 | 0.00 | 24.48  |
| 1959 | 0.67 | 3.03  | 0.00 | 0.52 | 0.49           | 0.11                                  | 2.09 | 3.58 | T    | 0.99 | 0.78 | 4.52 | 16.78  |
| 1960 | 1.09 | 2.15  | 0.53 | 0.15 | 0.60           | 0.17                                  | 1.64 | 6.49 | 1.68 | 3.72 | 0.62 | 0.07 | 18.91  |
| 1961 | 1.35 | T     | 2.31 | 0.18 | 0.20           | 1.04                                  | 5.11 | 3.67 | 0.68 | 0.44 | 0.92 | 1.18 | 17.10  |
| 1962 | 2.51 | 2.61  | 0.98 | T    | 0.37           | 0.13                                  | 2.54 | 1.84 | 3.20 | 0.14 | 0.72 | 0.69 | 15.73  |
| 1963 | 0.51 | 1.42  | 1.25 | 1.02 | 0.02           | 0.35                                  | 0.54 | 8.39 | 2.07 | 1.12 | 2.12 | T    | 18.81  |
| 1964 | 0.68 | 0.08  | 1.76 | 0.71 | 0.45           | 0.39                                  | 2.14 | 2.99 | 1.43 | 0.05 | 0.95 | 1.46 | 13.09  |
| 1965 | 2.49 | 3.32  | 2.04 | 4.00 | 0.83           | 0.77                                  | 3.01 | 1.52 | 5.20 | 0.40 | 5.40 | 6.96 | 35.94  |
| 1966 | 0.39 | 0.82  | 0.60 | T    | T              | 1.16                                  | 2.88 | 1.86 | 1.01 | 0.49 | 1.42 | 4.12 | 14.75  |
| 1967 | 0.79 | T     | 0.89 | 0.95 | 0.19           | 1.22                                  | 5.76 | 3.62 | 1.47 | 0.08 | 1.30 | 6.08 | 22.35  |



INSTITUTE OF ATMOSPHERIC PHYSICS, UNIVERSITY OF ARIZONA,  
AND THE U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU,  
CLIMATOGRAPHY OF THE UNITED STATES NO. 20-2

LATITUDE, 34° 33'  
LONGITUDE, 112° 27'  
ELEV. (GROUND), 5410 feet

CLIMATOLOGICAL SUMMARY

STATION, PRESCOTT

STATION NO. 02-6796-3

MEANS AND EXTREMES FOR PERIOD 1898 - 1957

| Month | Temperature (°F) |                  |         |                   |           |                  |           | Estimated mean<br>degree days** | Precipitation Totals (Inches) |              |           |                   |                    |           | Estimated mean<br>relative humidity<br>(percent) |           | Mean number<br>of days     |                  |                  |                  |                 | Month |
|-------|------------------|------------------|---------|-------------------|-----------|------------------|-----------|---------------------------------|-------------------------------|--------------|-----------|-------------------|--------------------|-----------|--------------------------------------------------|-----------|----------------------------|------------------|------------------|------------------|-----------------|-------|
|       | Means            |                  |         | Extremes          |           |                  |           |                                 | Alon                          | Greatest day | Year      | Snow, Sleet, Hail |                    |           | 0000-0500                                        | 1800-0500 | precip. 10<br>inch or more | Temperatures     |                  |                  |                 |       |
|       | Daily<br>maximum | Daily<br>minimum | Monthly | Record<br>highest | Year      | Record<br>lowest | Year      |                                 |                               |              |           | Mean              | Maximum<br>monthly | Year      |                                                  |           |                            | 90° and<br>above | 70° and<br>below | 32° and<br>below | 0° and<br>below |       |
|       |                  |                  |         |                   |           |                  |           |                                 |                               |              |           |                   |                    |           |                                                  |           |                            |                  |                  |                  |                 |       |
| (a)   | 57               | 57               | 56      | 57                | 57        | 57               | 57        | 58                              | 58                            | 58           | 57        | 57                | 57                 |           |                                                  | 58        | 51                         | 51               | 51               | 51               |                 |       |
| J     | 50.4             | 19.9             | 35.1    | 73                | 1927      | -21              | 1937      | 927                             | 1.95                          | 2.90         | 1911      | 9.0               | 53.0               | 1949      | 73                                               | 49        | 4                          | 0                | 1                | 28               | 1               | J     |
| F     | 53.7             | 23.0             | 38.4    | 76                | 1926      | -12              | 1899      | 745                             | 1.94                          | 3.81         | 1937      | 5.6               | 37.5               | 1932      | 75                                               | 40        | 4                          | 0                | *                | 25               | *               | F     |
| M     | 59.6             | 27.2             | 43.4    | 81                | 1934      | -2               | 1913      | 670                             | 1.76                          | 3.21         | 1938      | 5.1               | 28.0               | 1952      | 66                                               | 31        | 3                          | 0                | *                | 24               | 0               | M     |
| A     | 67.4             | 33.0             | 50.2    | 87                | 1949      | 11               | 1924      | 444                             | 1.08                          | 3.40         | 1917      | 1.1               | 8.5                | 1917      | 55                                               | 26        | 2                          | 0                | 0                | 14               | 0               | A     |
| M     | 75.6             | 39.2             | 57.4    | 97                | 1910      | 20               | 1915      | 254                             | 0.45                          | 1.30         | 1922      | 0.3               | 6.0                | 1915      | 44                                               | 20        | 1                          | 1                | 0                | 4                | 0               | M     |
| J     | 86.2             | 47.2             | 66.7    | 103               | 1929      | 25               | 1899      | 54                              | 0.39                          | 1.35         | 1954      | T                 | T                  | 1955      | 36                                               | 15        | 1                          | 10               | 0                | *                | 0               | J     |
| J     | 89.1             | 56.2             | 72.7    | 105               | 1929      | 34               | 1912      | 0                               | 2.93                          | 2.02         | 1921      | T                 | T                  | 1955      | 57                                               | 35        | 7                          | 15               | 0                | 0                | 0               | J     |
| A     | 86.3             | 54.9             | 70.7    | 102               | 1905      | 38               | 1957      | 0                               | 3.21                          | 2.65         | 1906      | T                 | T                  | 1955      | 68                                               | 40        | 7                          | 8                | 0                | 0                | 0               | A     |
| S     | 82.6             | 47.1             | 64.8    | 98                | 1950      | 26               | 1903      | 81                              | 1.51                          | 2.00         | 1923      | T                 | T                  | 1954      | 64                                               | 30        | 3                          | 4                | 0                | 1                | 0               | S     |
| O     | 72.3             | 35.6             | 54.0    | 90                | 1934      | 13               | 1935      | 361                             | 1.05                          | 2.40         | 1916      | 0.2               | 5.0                | 1949      | 66                                               | 35        | 2                          | *                | 0                | 11               | 0               | O     |
| N     | 61.1             | 25.9             | 43.5    | 83                | 1933      | -1               | 1931      | 645                             | 1.25                          | 4.28         | 1919      | 2.7               | 21.3               | 1906      | 65                                               | 42        | 3                          | 0                | 0                | 25               | 0               | N     |
| D     | 51.8             | 21.0             | 36.5    | 78                | 1926      | -9               | 1931      | 884                             | 1.77                          | 3.13         | 1951      | 5.7               | 37.0               | 1915      | 77                                               | 49        | 3                          | 0                | *                | 28               | 1               | D     |
| Year  | 69.7             | 35.8             | 52.8    | 105               | July 1925 | -21              | Jan. 1937 | 5045                            | 19.32                         | 4.28         | Nov. 1919 | 29.7              | 53.0               | Jan. 1949 | 62                                               | 34        | 40                         | 30               | 1                | 160              | 2               | Year  |

(a) Average length of record, years.

# Also on earlier dates, months, or years.

T Trace, an amount too small to measure.

\* Less than one half.

\*\* Base 65°A

CLIMATE OF PRESCOTT, ARIZONA

Prescott, at an elevation of about 5400 feet, is located in an intermediate and comparatively mountainous and colorful section of central Arizona between the forested plateaus to the northeast and the arid desert region to the southwest. It is bordered on the south and west by Prescott National Forest, which contains several mountain peaks rising above 7000 feet. The highest of these are Mount Union, at 7971 feet, ten miles to the south-southeast, and Granite Mountain, at 7626 feet, eight miles to the northwest. The terrain slopes downward toward the northeast into the sparsely vegetated Chino Valley. Across this valley and twenty miles from Prescott, lie the Black Hills, rising to almost 7800 feet on Woodchute Mountain and Mingo Mountain. Jerome, Arizona, an historic mining town, is located on the steep eastern slopes of these mountains. The vegetation at intermediate elevations in the area consists mainly of chaparral and oak woodland. Plains grass and desert plants may be found on the floor of the Chino Valley, while ponderosa pine forests are common above 6000 feet.

Prescott has a semi-arid climate with abundant precipitation only from early July through mid-September. During this period, when moist tropical air from the Gulf of Mexico dominates the area, thunderstorms develop almost every afternoon over the nearby mountains. They frequently spread out over Prescott, producing brief periods with gusty winds and heavy rainfall. These summer showers rarely last longer than a few hours and are replaced by almost clear skies shortly after sunset. In some years the remnants of dissipated tropical storms move into Arizona from the southwest during the summer, bringing with them several days of low clouds and moderate precipitation.

During the rest of the year, rainfall is generally deficient at Prescott. This is particularly true in May and June when average amounts are less than half an inch. A moderate increase in precipitation occurs in winter, when middle latitude storms from the Pacific Ocean occasionally move far enough south to affect northern Arizona, producing light or moderate showers which may continue intermittently for several days. These storms are particularly severe when they move onto the continent from off the coast of southern California. More than four inches of precipitation fell from such a storm on November 27, 1919. Slightly less than half of the winter precipitation falls as snow, which may accumulate to a depth of several feet during the colder winters, particularly on the northern slopes.

Because of its mild summer climate, Prescott is a favorite vacation spot for residents of the hot desert regions along the lower Colorado River Valley. Temperatures from June through September average between 65 and 70 degrees, varying from the upper forties or lower fifties at daybreak to the middle or upper eighties in the midafternoon. Only in about two out of every five summers are readings above 100 degrees recorded. The diurnal temperature range may frequently exceed forty degrees, especially in the late spring when the air is unusually dry.

(continued on the last page)

(continued from the first page)

Average winter temperatures at Prescott are above freezing in all months. The days are pleasantly warm with temperatures normally rising into the fifties. During the milder periods readings in the low seventies may occur. At night, the temperature usually falls rapidly to a minimum considerably below freezing. Minima below zero degrees occur on the average on one or two mornings in every other winter. In January 1937, the coldest month on record, sub-zero temperatures were recorded on twelve days. On ten of these days the afternoon maximum was below freezing. Fortunately, such extreme coldness is rare and probably not likely to occur more than once in a lifetime.

The following table gives some information on the normal dates of first and last occurrences of certain critical minimum temperatures, in the fall and spring, respectively, at Prescott.

| temperature<br>(°F) | normal date of first<br>occurrence in fall | normal date of last<br>occurrence in spring |
|---------------------|--------------------------------------------|---------------------------------------------|
| 32                  | Oct. 6                                     | May 19                                      |
| 28                  | Oct. 16                                    | Apr. 27                                     |
| 24                  | Oct. 27                                    | Apr. 13                                     |
| 20                  | Nov. 8                                     | Mar. 27                                     |
| 16                  | Nov. 17                                    | Mar. 14                                     |

The frost-free season lasts 140 days, permitting small crops of garden vegetables to be grown. Most of the range land in the Chino Valley is used for cattle grazing.

#### STATION HISTORY

| Observers                        | Dates                                        | Direction and Distance of<br>Station from Post Office | Elevation<br>(feet) | Station known as |
|----------------------------------|----------------------------------------------|-------------------------------------------------------|---------------------|------------------|
| Dr. W. E. Day<br>Dr. J. W. Flinn | May 1898 - Apr. 1908<br>May 1908 - Dec. 1937 | 0.5 mi. WSW                                           | 5500                | Prescott         |
| Claude Dalbom                    | Jan. 1938 - May 1940                         | 0.5 mi. ENE                                           | 5372                | "                |
| Claude Dalbom                    | June 1940 - July 1942                        | 0.6 mi. NE                                            | 5354                | "                |
| Arizona Highway Dept.            | July 1944 - Apr. 1945                        | 1.0 mi. ENE                                           | 5405                | "                |
| Prescott Fire Dept.              | Aug. 1945 - Feb. 1956                        | Opposite P. O.                                        | 5354                | "                |
| Radio Station KYCA               | Mar. 1956 -                                  | 1.0 mi. NE                                            | 5410                | "                |

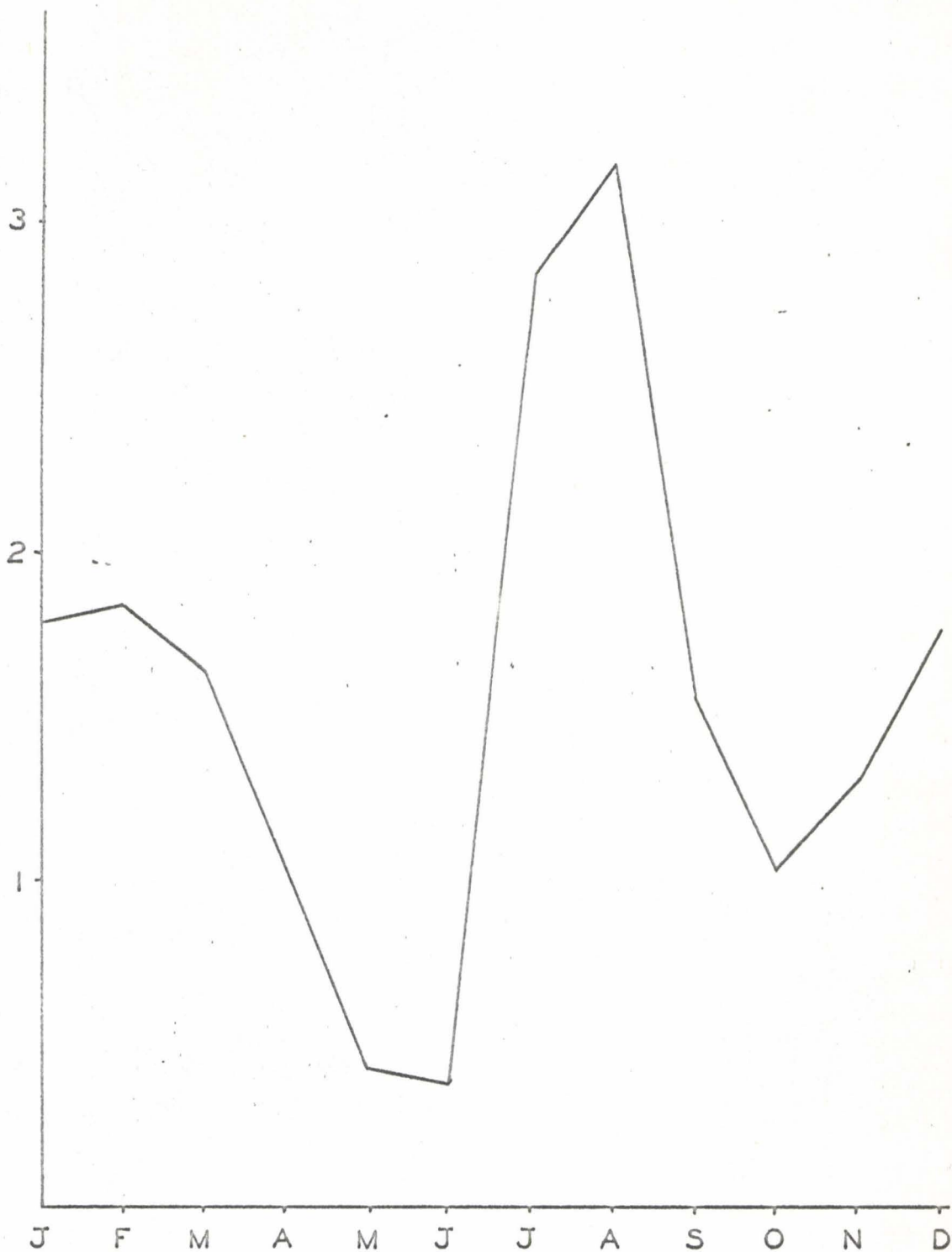
The weather records summarized in this publication were made available through the commendable civic spirit and interest of the above listed observers and organizations.

This climatological summary has been made possible by a cooperative agreement between the University of Arizona and the United States Weather Bureau. Under the terms of this agreement the Institute of Atmospheric Physics of the University of Arizona has put on IBM punched cards all available daily weather data for the years prior to 1948 for over 100 observation stations in Arizona. In turn, the Weather Bureau has reproduced for the Institute, without charge, cards containing similar, but more recent, information which it has routinely punched since 1948. From these daily cards the Institute has produced, for all stations, summary cards which contain average weather data for each five-day period and each month of record. All of these decks of IBM punched cards are available for research work on request.

Copies of this climatological summary can be obtained from the Institute of Atmospheric Physics, University of Arizona, Tucson 25, Arizona.

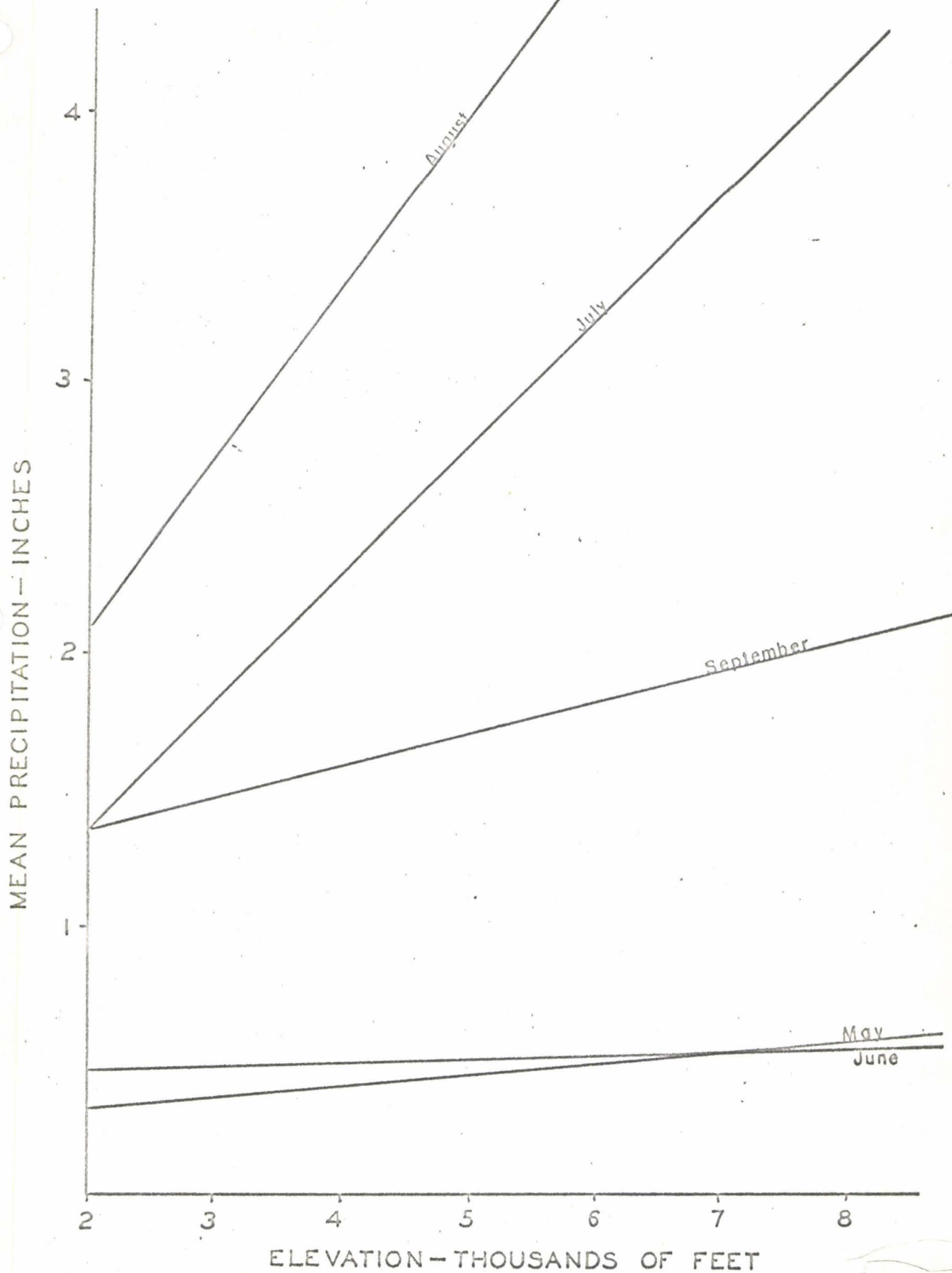


PRECIPITATION - INCHES



AVERAGE MONTHLY PRECIPITATION  
PRESCOTT, ARIZONA

# SUMMER PRECIPITATION-ELEVATION RELATION





# WINTER PRECIPITATION-ELEVATION RELATION

MEAN PRECIPITATION - INCHES

4

3

2

1

2

3

4

5

6

7

8

ELEVATION-THOUSANDS OF FEET

December

January

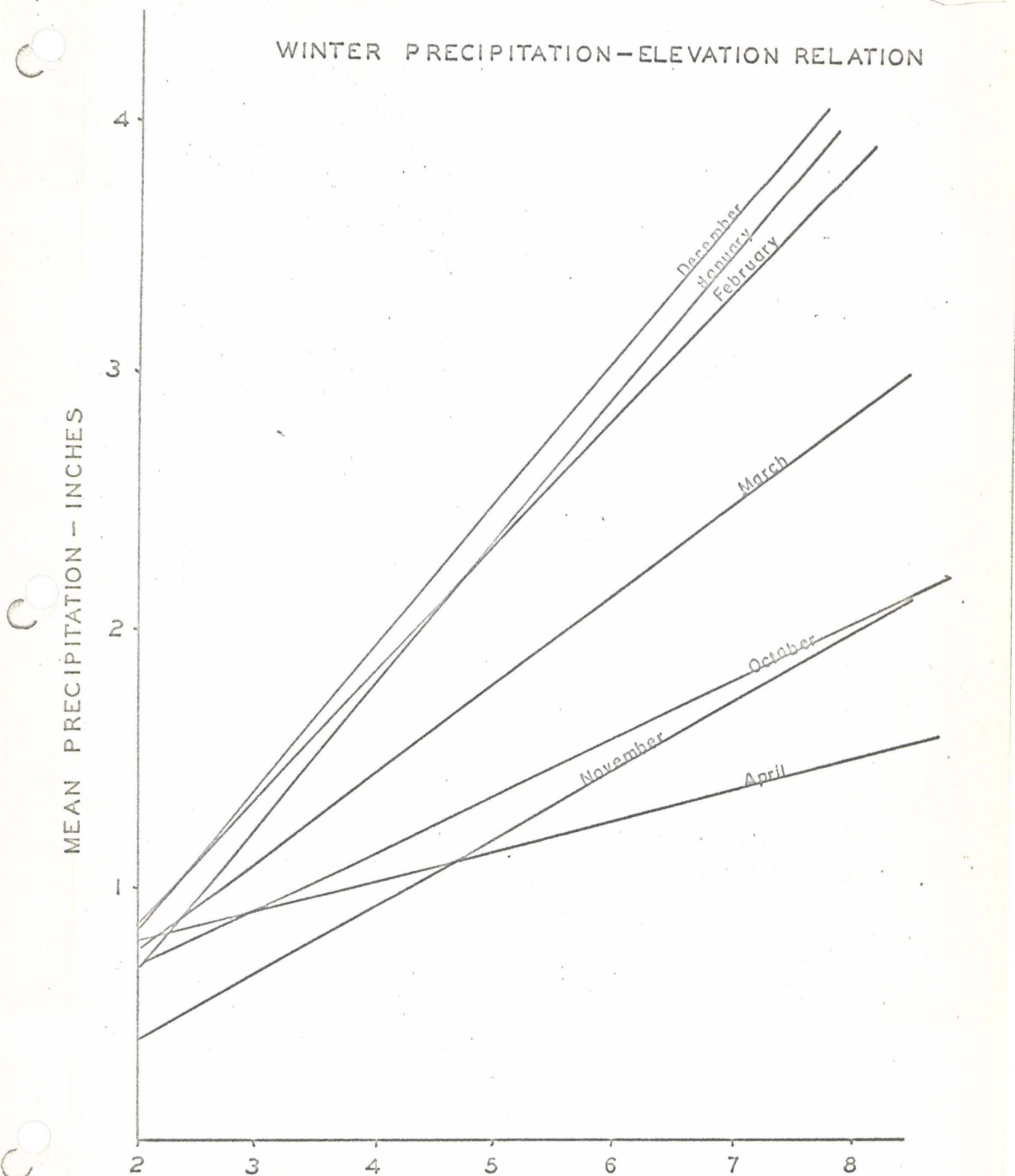
February

March

October

November

April



AVERAGE MONTHLY TEMPERATURES (°F) FOR PRESCOTT, ARIZONA

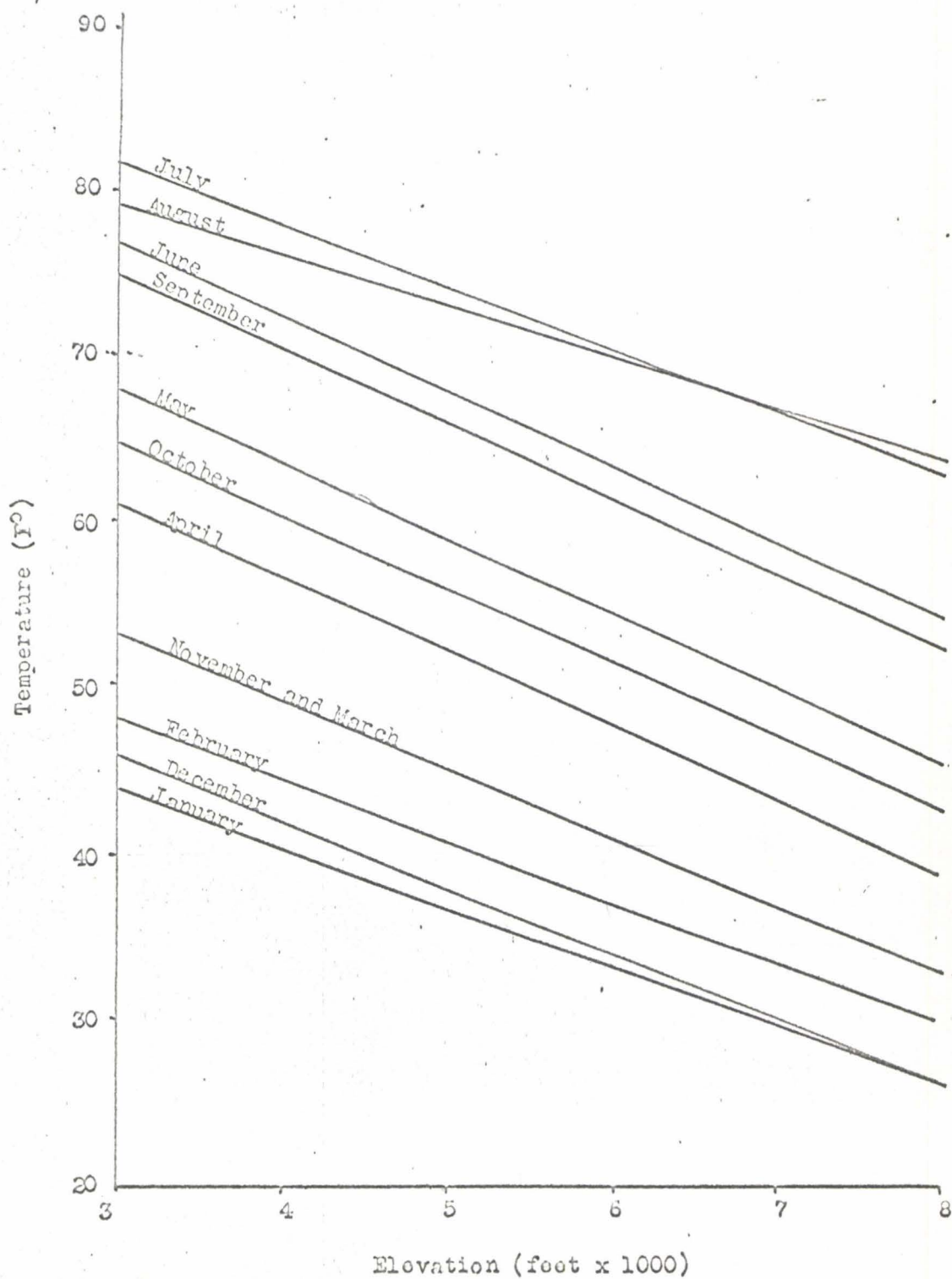
| Year | Jan.  | Feb.  | Mar.  | Apr.                                  | May            | June  | July  | Aug.  | Sep.  | Oct.  | Nov.  | Dec.  | Annual |
|------|-------|-------|-------|---------------------------------------|----------------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1898 |       |       |       |                                       |                |       |       |       |       | 58.2  | 45.4  | 34.3  |        |
| 1899 | 35.6  | 38.8  | 44.3  | 50.2                                  |                | 67.0  | 73.0  | 67.6  | 69.1  | 52.3  | 45.6  | 39.1  |        |
| 1900 | 40.9  | 40.4  | 48.9  | 45.4                                  | 57.8           | 68.7  | 74.0  | 67.4  | 59.5  | 53.7  | 44.8  | 38.2  | 53.3   |
| 1901 | 36.1  | 38.4  | 42.6  | 48.7                                  | 58.8           | 64.2  | 74.8  | 72.7  |       | 53.3  | 46.2  | 36.6  |        |
| 1902 | 34.6  | 39.3  | 38.2  | 51.2                                  | 56.5           | 67.8  | 69.6  | 68.1  | 63.0  | 54.3  | 40.3  | 33.6  | 51.4   |
| 1903 | 35.7  | 30.9* | 42.8  | 47.1                                  | 54.5           | 63.9  | 67.4  | 69.7  | 61.4  | 49.1  | 45.7  | 33.6  | 50.2   |
| 1904 | 31.5  | 39.7  | 46.7  | 47.7                                  | 55.2           | 64.8  | 73.9  | 82.6  |       |       |       | 38.1  |        |
| 1905 | 39.1  | 31.5  | 45.4  | 49.9                                  | 54.3           | 67.0  | 74.0  | 73.0  | 67.6  | 59.5  | 44.1  | 34.5  | 53.3   |
| 1906 | 36.8  | 38.7  | 43.9  | 49.5                                  | 56.7           | 64.2  | 73.4  | 69.6  | 61.5  | 53.8  | 41.4  | 39.2  | 52.4   |
| 1907 | 34.2  |       |       |                                       | 54.7           |       |       |       |       |       |       |       |        |
| 1908 |       |       |       |                                       |                | 65.3  | 73.7  | 70.2  | 63.3  | 49.8  | 43.7  | 36.3  |        |
| 1909 | 40.8  | 38.2  | 40.0  | 49.2                                  | 55.1           | 67.5  | 71.4  | 69.3  | 62.9  | 53.7  | 46.2  | 32.7  | 52.2   |
| 1910 | 35.3  | 38.8  | 48.5  | 52.4                                  | 61.9           | 67.3  | 72.5  | 71.1  | 67.5  | 54.3  | 46.2  | 41.0  | 54.7   |
| 1911 | 39.4  | 36.5  | 46.1  | 49.2                                  | 53.8           | 64.7  | 69.6  | 70.2  | 65.1  | 52.2  | 40.8  | 29.6  | 51.4   |
| 1912 | 36.2  | 38.8  | 40.8  | 44.8                                  | 55.3           | 67.4  | 67.6  | 67.5  | 59.0  | 49.5  | 43.0  | 32.1  | 50.2   |
| 1913 | 30.5  | 34.5  | 38.2  | 48.0                                  | 55.9           | 63.7  | 69.4  | 69.1  | 61.6  | 51.7  | 44.5  | 33.4  | 50.0   |
| 1914 | 38.6  | 37.6  | 44.7  | 50.4                                  | 58.1           | 65.8  | 70.4  | 70.7  | 65.3  | 53.0  | 46.1  | 33.2  | 52.8   |
| 1915 | 32.9  | 37.7  | 41.3  | 49.1                                  | 53.3           | 64.8  | 70.6  | 71.5  | 61.8  | 55.6  | 43.2  | 34.7  | 51.4   |
| 1916 | 32.6  | 42.0  | 46.6  | 50.8                                  | 55.3           | 66.2  | 71.4  | 68.0  | 63.1  | 49.9  | 40.6  | 33.1  | 51.6   |
| 1917 | 30.5  | 36.9  | 38.3  | 46.8                                  | 50.8           | 66.2  | 73.5  | 69.7* | 64.5  | 55.2  | 46.2  | 41.7  | 51.7   |
| 1918 | 34.5  | 40.2  | 44.4  | 49.8                                  | 54.0           | 71.5  | 69.9  | 68.5  | 66.2  | 56.6  |       | 38.2* |        |
| 1919 |       | 36.0  | 44.4  | 54.2*                                 |                | 67.8  |       | 70.0  |       | 48.0  | 41.0  | 36.9  |        |
| 1920 | 36.6  | 41.1  | 41.2  | 46.6                                  | 58.0           | 65.6  | 72.8  | 69.1  | 63.7  | 51.2  | 42.4  | 33.0  | 51.8   |
| 1921 | 37.0  | 41.0  | 46.5  | 48.9                                  | 55.0           | 67.2  | 71.5  | 69.6  | 64.4  | 56.3  | 46.5  | 41.5  | 53.8   |
| 1922 | 32.5  | 35.2  | 41.0  | 47.4                                  | 59.5           | 69.7  | 74.6  | 71.2  | 67.8  | 53.8  | 38.7  | 38.3  | 52.5   |
| 1923 | 38.5  | 36.0  | 41.0  | 48.8                                  | 59.3           | 61.9  | 71.2  | 68.9  | 61.0  | 48.3  | 42.8  | 34.0  | 51.0   |
| 1924 | 29.8* | 40.2  | 38.3  | 47.5                                  | 59.8           | 70.8  | 72.2  | 72.2  | 65.0* | 54.1* | 48.4  | 35.2  | 52.8   |
| 1925 | 34.0* | 42.8  | 45.6* | 51.0                                  | 60.5           | 67.1  | 74.2* | 69.5* | 62.3  | 52.3  | 42.1  | 37.6  | 53.2   |
| 1926 | 32.9  | 41.4  | 45.3* | 51.1                                  | 57.5           | 69.6  | 73.0  | 70.8* | 65.9* | 56.6* | 46.2* | 33.2  | 53.6   |
| 1927 | 40.2* | 41.7* | 43.1* | 49.6*                                 | 59.2*          | 66.3* | 73.1* | 69.9* | 64.1* | 54.3* | 45.8* | 32.4* | 53.3   |
| 1928 | 36.1* | 37.5* | 46.0* | 51.1*                                 | 59.8*          | 67.2* | 74.3* | 71.5* | 66.0* | 54.8* | 41.6* | 31.4  | 53.1   |
| 1929 | 31.3* | 33.5  | 41.4  | 48.2                                  | 59.0           | 68.0* | 73.5  | 69.7  | 64.1* | 55.3* | 40.5  | 40.3  | 52.1   |
| 1930 | 31.9  | 41.6  | 41.6* | 53.6*                                 | 52.9*          | 67.6* | 71.3* | 70.2* | 63.6  | 50.9  | 40.6* | 33.5  | 51.6   |
| 1931 | 34.1* | 39.7* | 44.2* | 53.5                                  | 60.2           | 67.6* | 75.8  | 71.7* | 65.0  | 53.4* | 38.8* | 30.5  | 52.9   |
| 1932 | 28.5* | 37.9  | 43.9  | 50.3*                                 | 57.4           | 65.0  | 73.9  | 72.0  | 66.1  | 53.2  | 45.7* | 28.5* | 51.9   |
| 1933 | 28.0  | 20.7  | 44.1* | 46.7                                  | 53.1*          | 68.9  | 76.6  | 73.2  | 68.5  | 57.5* | 45.1  | 39.1  | 52.5   |
| 1934 | 36.6  | 42.1  | 50.8  | 55.2                                  | 64.5           | 64.2  | 76.2  | 71.3  | 64.9  | 56.5  | 44.5  | 38.5  | 55.4   |
| 1935 | 34.8  | 39.9  | 40.5  | 51.3                                  | 54.4           | 69.7* | 73.7* | 71.3  | 65.0  | 52.5  | 40.7  | 35.0  | 52.4   |
| 1936 | 36.0  | 37.9  | 43.8  | 53.3                                  | 60.4           | 70.5  | 73.8  | 71.8* | 63.7* | 53.3  | 41.5* | 34.0  | 53.3   |
| 1937 | 20.0  | 35.1  | 40.2  | 49.2                                  | 59.1           | 66.1  | 72.9  | 73.6  |       | 56.6  | 46.2  | 40.3* |        |
| 1938 | 40.3  | 39.3  | 43.9  | 52.8                                  | 58.6           | 67.2  | 72.0  | 71.5  | 67.2  | 53.9  | 39.9  | 39.7  | 53.9   |
| 1939 | 36.7  | 30.5  | 45.3  | 54.4                                  | 60.5           | 68.4  | 75.7  | 72.5  | 64.7  | 53.0  | 46.2  | 42.6  | 54.2   |
| 1940 | 39.3  | 40.5  | 47.2  | 52.8                                  | 62.3           | 71.1  | 73.8  | 72.9  | 64.4  | 54.6  | 41.1  | 40.4  | 55.0   |
| 1941 | 37.6  | 42.5  | 43.6  | 44.9                                  | 57.3           | 62.7  | 71.4  | 68.4  | 61.5  | 50.0  | 44.3* | 37.4  | 51.8   |
| 1942 | 36.4  | 35.5  | 41.7  | 49.7                                  | 55.9           | 65.4  | 75.2  |       |       |       |       |       |        |
| 1943 |       |       |       | station closed, Aug. 1942 - June 1944 |                |       |       |       |       |       |       |       |        |
| 1944 |       |       |       |                                       |                | 69.3* | 72.4* | 65.5* | 57.9* | 42.8  | 39.6  |       | 53.0   |
| 1945 |       | 41.3* | 37.9* | 49.3*                                 | station closed |       |       |       | 65.6  | 56.2  | 42.9  | 33.8  |        |
| 1946 | 35.1  | 37.8  | 44.9* | 53.6                                  | 57.1           | 66.9  | 71.2  | 69.9  | 64.7  | 49.0  | 40.5  | 40.5  | 52.6   |
| 1947 | 33.6  | 43.2  | 45.8  | 51.2                                  |                | 67.2  | 74.8  | 70.6  | 68.5  | 54.8* | 38.5  | 34.2  |        |
| 1948 |       |       | 39.2* | 51.9                                  | 58.7           | 65.6  | 71.9* | 70.5  | 65.5  | 54.0  | 38.9* | 37.6  |        |
| 1949 | 25.3  | 32.0  | 43.2  | 53.3                                  | 57.3           | 66.8  | 73.2  |       |       | 50.4  | 48.7* | 34.1  |        |
| 1950 | 34.9  | 43.2  | 45.4* | 54.4                                  | 56.8           | 65.4  | 70.7  | 69.5  | 61.3  | 59.5  | 47.4  | 43.1  | 54.3   |
| 1951 | 36.3  | 38.4  | 41.9  | 49.2                                  | 56.2           | 63.5  | 73.7  | 68.1  | 65.4  | 53.6  | 42.6  | 35.8  | 52.1   |
| 1952 | 35.2  | 37.9  | 37.2  | 50.4                                  | 59.7           | 64.5  | 70.6  | 71.7  | 66.2  | 58.5  | 39.1  | 35.8  | 52.2   |
| 1953 | 42.2  | 38.7  | 44.5  | 50.1                                  | 52.4           | 65.7  | 72.5  | 69.3  | 65.0  | 53.0  | 46.5  | 34.9  | 52.9   |
| 1954 | 38.0  | 44.0  | 42.2  | 54.8                                  | 60.0           | 65.4  | 73.4  | 68.9  | 66.1* | 57.0  | 47.3  | 37.2  | 54.5   |
| 1955 | 31.7  | 35.1  | 44.2  | 48.6                                  | 57.2           | 64.9  | 69.3  | 70.3  | 65.0  | 57.8  | 45.1  | 42.1  | 52.6   |
| 1956 | 41.8  | 35.0  | 45.3  | 49.4                                  | 60.2*          | 70.0  | 72.4  | 69.5* | 69.3  | 54.7  | 41.5  | 36.1  | 53.8   |
| 1957 | 37.3  | 45.0  | 45.4  | 49.2                                  | 54.1*          | 69.5  | 74.0* | 70.4  | 65.6  | 53.0  | 40.2* | 39.6* | 53.6   |
| 1958 | 35.4  | 41.3* | 38.3* | 49.4                                  | 62.0           | 67.9* | 72.7  | 72.0  | 64.1  | 55.2  | 42.6  | 42.1  | 53.6   |
| 1959 | 38.7  | 36.2  | 45.3  | 53.9                                  | 56.9           | 69.9  | 76.2  | 69.6  | 64.0  | 55.8  | 44.1  | 38.9* | 54.1   |
| 1960 | 30.4  | 36.1  | 48.3  |                                       |                |       |       |       |       |       |       |       |        |

\* average temperature missing on one through five days during the month



# GRAPH OF ELEVATION - TEMPERATURE

## AGUA FRIA WATERSHED



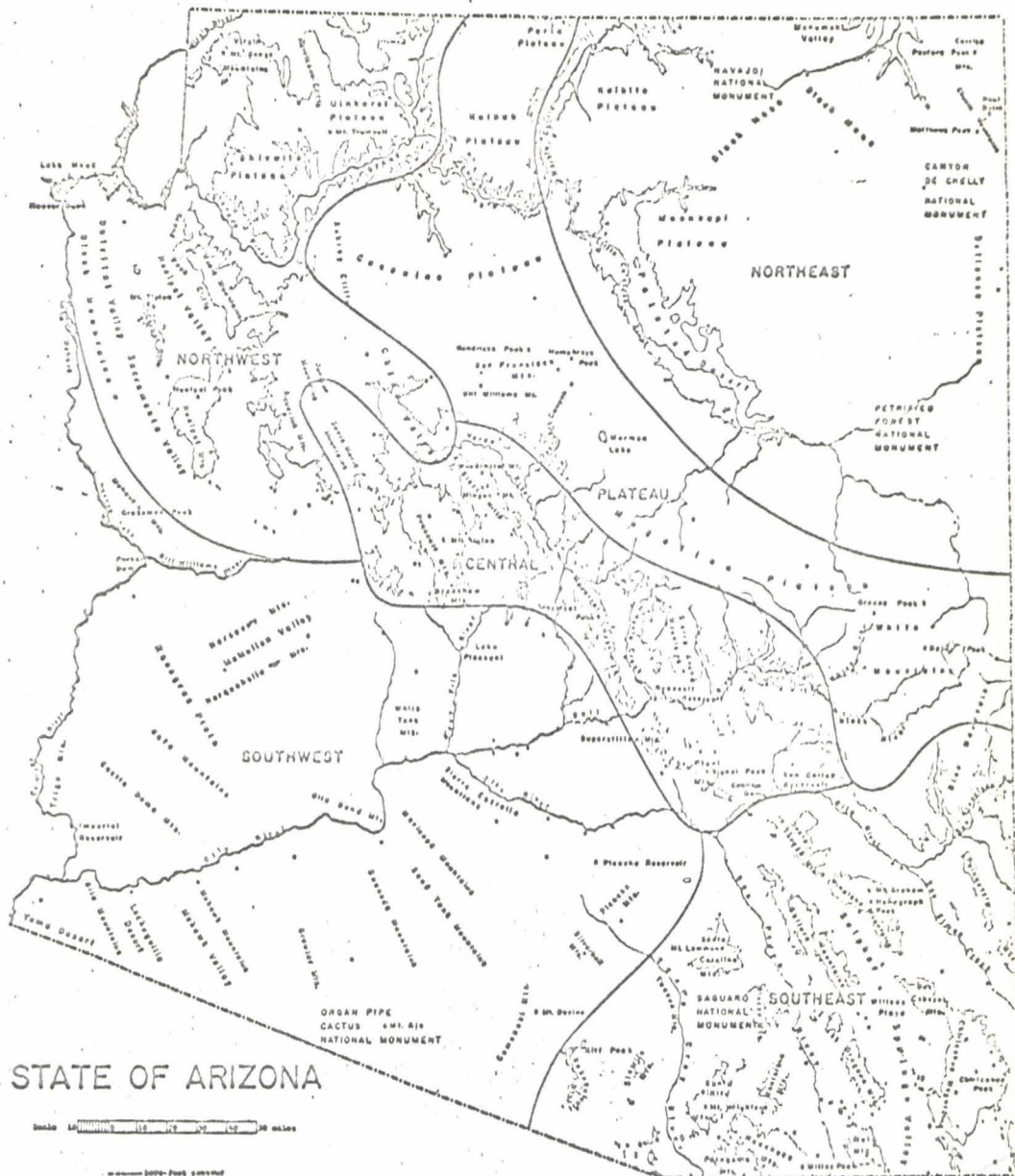


FIGURE 2. Topographical features of Arizona and section boundaries.



TABLE 3a. Wind data for Prescott, Arizona. Based on records for the period January 1948 - December 1955.

| observation time | month | wind direction |             | percent of calms | wind speed* (miles per hour) |         |
|------------------|-------|----------------|-------------|------------------|------------------------------|---------|
|                  |       | prevailing     | constancy** |                  | average                      | maximum |
| 0:20 a.m.        | Jan   | SSW            | 63          | 13               | 6.3                          | 25      |
|                  | Apr   | SW             | 75          | 7                | 7.6                          | 35      |
|                  | Jul   | SW             | 72          | 11               | 6.9                          | 15      |
|                  | Oct   | SSW            | 79          | 10               | 7.1                          | 29      |
| 3:20 a.m.        | Jan   | SW             | 68          | 14               | 6.2                          | 30      |
|                  | Apr   | SSW            | 77          | 10               | 7.2                          | 29      |
|                  | Jul   | SW             | 65          | 20               | 5.9                          | 23      |
|                  | Oct   | SW             | 79          | 15               | 6.3                          | 23      |
| 6:20 a.m.        | Jan   | SW             | 65          | 14               | 6.2                          | 29      |
|                  | Apr   | SW             | 73          | 8                | 6.9                          | 33      |
|                  | Jul   | SW             | 61          | 19               | 5.2                          | 15      |
|                  | Oct   | SW             | 79          | 10               | 6.2                          | 18      |
| 9:20 a.m.        | Jan   | S              | 45          | 21               | 5.2                          | 30      |
|                  | Apr   | N              | 40          | 8                | 9.4                          | 35      |
|                  | Jul   | N              | 33          | 16               | 5.8                          | 18      |
|                  | Oct   | N              | 50          | 15               | 5.5                          | 27      |
| 12:20 p.m.       | Jan   | N              | 50          | 8                | 8.2                          | 33      |
|                  | Apr   | SSW            | 49          | 2                | 12.4                         | 35      |
|                  | Jul   | SW             | 45          | 8                | 8.9                          | 23      |
|                  | Oct   | ESE            | 35          | 6                | 9.4                          | 35      |
| 3:20 p.m.        | Jan   | EW             | 40          | 7                | 8.9                          | 35      |
|                  | Apr   | SW             | 62          | 4                | 14.2                         | 33      |
|                  | Jul   | SW             | 64          | 3                | 11.9                         | 33      |
|                  | Oct   | SW             | 47          | 4                | 10.5                         | 33      |
| 6:20 p.m.        | Jan   | SW             | 43          | 16               | 6.5                          | 40      |
|                  | Apr   | WSW            | 75          | 2                | 12.7                         | 32      |
|                  | Jul   | SW             | 64          | 3                | 10.5                         | 30      |
|                  | Oct   | SW             | 69          | 6                | 7.5                          | 23      |
| 9:20 p.m.        | Jan   | SW             | 65          | 13               | 7.1                          | 30      |
|                  | Apr   | SW             | 60          | 4                | 8.5                          | 23      |
|                  | Jul   | SW             | 75          | 10               | 6.9                          | 28      |
|                  | Oct   | SW             | 78          | 9                | 7.3                          | 23      |

On November 29, 1954 the Weather Bureau office at the Prescott airport reported gusts to seventy-two miles per hour during a severe wind storm. This is the strongest wind speed ever recorded at the station.

\* values given are the average and maximum one minute wind speeds.

\*\* values given are the percentage of the time that the wind blows within 45 degrees of the prevailing direction.

† less than one percent

TABLE 3a. Wind data for Phoenix, Arizona. Based on records for the period January 1948 - December 1955.

| observation time | month | wind direction |             | percent of calms | wind speed* (miles per hour) |         |
|------------------|-------|----------------|-------------|------------------|------------------------------|---------|
|                  |       | prevailing     | constancy** |                  | average                      | maximum |
| 0:20 a.m.        | Jan   | E              | 59          | 19               | 3.5                          | 15      |
|                  | Apr   | E              | 50          | 13               | 4.1                          | 17      |
|                  | Jul   | E              | 45          | 10               | 5.1                          | 20      |
|                  | Oct   | SE             | 54          | 24               | 3.2                          | 17      |
| 3:20 a.m.        | Jan   | E              | 65          | 15               | 3.8                          | 15      |
|                  | Apr   | E              | 65          | 13               | 4.2                          | 15      |
|                  | Jul   | E              | 55          | 10               | 4.3                          | 17      |
|                  | Oct   | E              | 74          | 13               | 3.8                          | 10      |
| 6:20 a.m.        | Jan   | E              | 63          | 17               | 3.9                          | 18      |
|                  | Apr   | E              | 73          | 11               | 4.5                          | 15      |
|                  | Jul   | E              | 63          | 14               | 4.0                          | 13      |
|                  | Oct   | E              | 76          | 14               | 4.2                          | 13      |
| 9:20 a.m.        | Jan   | E              | 73          | 9                | 4.4                          | 15      |
|                  | Apr   | ESE            | 70          | 5                | 6.1                          | 19      |
|                  | Jul   | SE             | 40          | 12               | 4.5                          | 15      |
|                  | Oct   | SE             | 73          | 9                | 5.9                          | 16      |
| 12:20 p.m.       | Jan   | SE             | 52          | 12               | 4.8                          | 20      |
|                  | Apr   | SE             | 40          | 3                | 6.2                          | 20      |
|                  | Jul   | W              | 53          | 6                | 6.0                          | 21      |
|                  | Oct   | SE             | 54          | 9                | 5.6                          | 25      |
| 3:20 p.m.        | Jan   | W              | 45          | 6                | 5.1                          | 29      |
|                  | Apr   | W              | 66          | 3                | 8.3                          | 23      |
|                  | Jul   | W              | 71          | 2                | 7.6                          | 18      |
|                  | Oct   | W              | 49          | 5                | 5.9                          | 22      |
| 6:20 p.m.        | Jan   | EW             | 34          | 28               | 4.8                          | 20      |
|                  | Apr   | EW             | 59          | 2                | 7.0                          | 25      |
|                  | Jul   | W              | 66          | 2                | 7.9                          | 25      |
|                  | Oct   | EW             | 40          | 29               | 2.7                          | 18      |
| 9:20 p.m.        | Jan   | E              | 42          | 32               | 2.7                          | 17      |
|                  | Apr   | W              | 38          | 22               | 3.9                          | 18      |
|                  | Jul   | SE             | 40          | 15               | 5.5                          | 22      |
|                  | Oct   | E              | 35          | 35               | 2.4                          | 15      |

On September 18, 1950 the Weather Bureau office at the Phoenix airport reported a one minute wind speed of fifty miles per hour and gusts to seventy-five miles per hour during a severe thunderstorm. These are the strongest winds on record at the station.

TABLE 4c. Cloudiness data for Prescott, Arizona. Based on records for the period January 1948 - March 1958.

| hour              | month | average cloud cover (tenths) | monthly average no. of |               | prevailing cloud type |
|-------------------|-------|------------------------------|------------------------|---------------|-----------------------|
|                   |       |                              | clear days*            | cloudy days** |                       |
| 6:20 a.m.         | Jan   | 3.7                          | 18                     | 9             | altocumulus           |
|                   | Mar   | 4.2                          | 16                     | 10            | cirrus                |
|                   | Jun   | 1.6                          | 24                     | 3             | cirrus                |
|                   | Jul   | 4.2                          | 16                     | 9             | altocumulus           |
|                   | Sep   | 1.8                          | 24                     | 3             | altocumulus           |
|                   | Nov   | 2.2                          | 23                     | 4             | cirrus                |
| 9:20 a.m.         | Jan   | 4.9                          | 15                     | 13            | cirrus                |
|                   | Mar   | 4.6                          | 15                     | 11            | cirrus                |
|                   | Jun   | 1.7                          | 24                     | 4             | altocumulus           |
|                   | Jul   | 3.8                          | 17                     | 8             | altocumulus           |
|                   | Sep   | 1.8                          | 24                     | 3             | altocumulus           |
|                   | Nov   | 2.8                          | 21                     | 6             | cirrus                |
| 12:20 p.m.        | Jan   | 5.2                          | 13                     | 13            | cirrus                |
|                   | Mar   | 5.0                          | 13                     | 13            | cirrus                |
|                   | Jun   | 2.3                          | 22                     | 4             | cumulus               |
|                   | Jul   | 5.1                          | 11                     | 10            | cumulus               |
|                   | Sep   | 2.6                          | 21                     | 4             | cumulus               |
|                   | Nov   | 3.2                          | 19                     | 7             | cirrus                |
| 3:20 p.m.         | Jan   | 5.3                          | 13                     | 14            | cirrus                |
|                   | Mar   | 5.5                          | 12                     | 14            | cumulus               |
|                   | Jun   | 2.7                          | 21                     | 5             | cumulus               |
|                   | Jul   | 6.0                          | 9                      | 13            | cumulus               |
|                   | Sep   | 3.2                          | 18                     | 5             | cumulus               |
|                   | Nov   | 3.5                          | 18                     | 8             | cirrus                |
| 6:20 p.m.         | Jan   | 4.9                          | 14                     | 12            | cirrus                |
|                   | Mar   | 4.8                          | 14                     | 11            | cirrus                |
|                   | Jun   | 2.4                          | 22                     | 4             | cumulus               |
|                   | Jul   | 5.5                          | 12                     | 13            | cumulonimbus          |
|                   | Sep   | 2.4                          | 22                     | 4             | altocumulus           |
|                   | Nov   | 2.8                          | 21                     | 6             | cirrus                |
| sunrise to sunset | Jan   | 5.2                          | 12                     | 11            | cirrus                |
|                   | Mar   | 4.9                          | 12                     | 10            | cirrus                |
|                   | Jun   | 2.3                          | 22                     | 2             | cumulus               |
|                   | Jul   | 4.8                          | 11                     | 8             | cumulus               |
|                   | Sep   | 3.1                          | 21                     | 3             | altocumulus           |
|                   | Nov   | 3.4                          | 17                     | 6             | cirrus                |

TABLE 4c. Cloudiness data for Phoenix, Arizona. Based on records for the period January 1948 - March 1958.

| hour              | month | average cloud cover (tenths) | monthly average no. of |               | prevailing cloud type |
|-------------------|-------|------------------------------|------------------------|---------------|-----------------------|
|                   |       |                              | clear days*            | cloudy days** |                       |
| 6:20 a.m.         | Jan   | 3.4                          | 20                     | 9             | stratocumulus         |
|                   | Mar   | 4.1                          | 17                     | 11            | cirrus                |
|                   | Jun   | 1.5                          | 25                     | 3             | cirrus                |
|                   | Jul   | 5.0                          | 13                     | 11            | altocumulus           |
|                   | Sep   | 1.9                          | 23                     | 3             | altocumulus           |
|                   | Nov   | 1.9                          | 24                     | 4             | cirrus                |
| 9:20 a.m.         | Jan   | 4.6                          | 16                     | 12            | cirrus                |
|                   | Mar   | 4.2                          | 17                     | 11            | cirrus                |
|                   | Jun   | 1.7                          | 24                     | 4             | cirrus                |
|                   | Jul   | 4.2                          | 16                     | 9             | altocumulus           |
|                   | Sep   | 1.7                          | 24                     | 4             | altocumulus           |
|                   | Nov   | 2.8                          | 21                     | 8             | cirrus                |
| 12:20 p.m.        | Jan   | 4.9                          | 14                     | 13            | cirrus                |
|                   | Mar   | 4.3                          | 17                     | 11            | cirrus                |
|                   | Jun   | 1.7                          | 24                     | 4             | cirrus                |
|                   | Jul   | 3.5                          | 19                     | 7             | altocumulus           |
|                   | Sep   | 1.5                          | 25                     | 3             | cumulus               |
|                   | Nov   | 2.8                          | 21                     | 7             | cirrus                |
| 3:20 p.m.         | Jan   | 4.7                          | 15                     | 13            | cirrus                |
|                   | Mar   | 4.9                          | 15                     | 12            | cumulus               |
|                   | Jun   | 1.9                          | 24                     | 4             | cirrus                |
|                   | Jul   | 3.3                          | 19                     | 6             | cirrus                |
|                   | Sep   | 1.4                          | 25                     | 2             | cumulus               |
|                   | Nov   | 3.1                          | 20                     | 8             | cirrus                |
| 6:20 p.m.         | Jan   | 4.3                          | 18                     | 12            | cirrus                |
|                   | Mar   | 4.8                          | 14                     | 13            | cirrus                |
|                   | Jun   | 1.8                          | 24                     | 4             | cirrus                |
|                   | Jul   | 4.6                          | 15                     | 11            | cirrus                |
|                   | Sep   | 2.0                          | 22                     | 4             | cumulus               |
|                   | Nov   | 2.5                          | 21                     | 5             | cirrus                |
| sunrise to sunset | Jan   | 5.1                          | 13                     | 10            | cirrus                |
|                   | Mar   | 4.4                          | 15                     | 9             | cirrus                |
|                   | Jun   | 2.0                          | 23                     | 2             | cirrus                |
|                   | Jul   | 3.8                          | 16                     | 5             | altocumulus           |
|                   | Sep   | 2.0                          | 22                     | 3             | cumulus               |
|                   | Nov   | 3.0                          | 19                     | 5             | cirrus                |

\* cloud cover of three-tenths or less

\*\* cloud cover of eight-tenths or more



INSTITUTE OF ATMOSPHERIC PHYSICS, UNIVERSITY OF ARIZONA,  
AND THE U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU,  
CLIMATOGRAPHY OF THE UNITED STATES NO. 20-2

LATITUDE: 34° 12'  
LONGITUDE: 112° 20'  
ELEV. (GROUND): 6000 feet

CLIMATOLOGICAL SUMMARY

STATION: CROWN KING

STATION NO: 02-2329-3

MEANS AND EXTREMES FOR PERIOD 1915 - 1937

| Month                       | Temperature (°F) |               |         |                |      |               |      | Estimated mean degree days* | Precipitation Totals (inches) |                |      |                   |                 |      |              | Estimated mean relative humidity (percent) |              | Mean number of days |  |  |  |      | Month |
|-----------------------------|------------------|---------------|---------|----------------|------|---------------|------|-----------------------------|-------------------------------|----------------|------|-------------------|-----------------|------|--------------|--------------------------------------------|--------------|---------------------|--|--|--|------|-------|
|                             | Means            |               |         | Extremes       |      |               |      |                             | Mean                          | Greatest daily | Year | Snow, Sleet, Hail |                 |      | Temperatures |                                            |              |                     |  |  |  |      |       |
|                             | Daily maximum    | Daily minimum | Monthly | Record highest | Year | Record lowest | Year |                             |                               |                |      | Mean              | Maximum monthly | Year | Max.         |                                            | Min.         |                     |  |  |  |      |       |
|                             |                  |               |         |                |      |               |      |                             |                               |                |      |                   |                 |      | 90 and above | 32 and below                               | 32 and below | 0 and below         |  |  |  |      |       |
| (a)                         |                  |               |         |                |      |               |      | 40                          | 40                            | 40             | 40   | 40                | 40              |      |              | 40                                         |              |                     |  |  |  | J    |       |
| J                           |                  |               |         |                |      |               |      | 3.27                        | 3.70                          | 1922           | 13.6 | 45.5              | 1945            |      |              | 4                                          |              |                     |  |  |  | F    |       |
| F                           |                  |               |         |                |      |               |      | 2.75                        | 2.54                          | 1931           | 10.4 | 52.0              | 1932            |      |              | 4                                          |              |                     |  |  |  | M    |       |
| M                           |                  |               |         |                |      |               |      | 2.32                        | 3.21                          | 1954           | 8.6  | 48.0              | 1945            |      |              | 3                                          |              |                     |  |  |  | A    |       |
| A                           |                  |               |         |                |      |               |      | 1.83                        | 3.51                          | 1941           | 2.4  | 18.0              | 1915            |      |              | 2                                          |              |                     |  |  |  | M    |       |
| M                           |                  |               |         |                |      |               |      | 0.57                        | 1.55                          | 1937           | 0.2  | 5.0               | 1930            |      |              | 1                                          |              |                     |  |  |  | M    |       |
| J                           |                  |               |         |                |      |               |      | 0.48                        | 1.68                          | 1932           | T    | T                 | 1955#           |      |              | 1                                          |              |                     |  |  |  | J    |       |
| INSUFFICIENT DATA AVAILABLE |                  |               |         |                |      |               |      |                             |                               |                |      |                   |                 |      |              |                                            |              |                     |  |  |  |      |       |
| J                           |                  |               |         |                |      |               |      | 3.58                        | 3.18                          | 1955           | T    | T                 | 1954#           |      |              | 6                                          |              |                     |  |  |  | J    |       |
| A                           |                  |               |         |                |      |               |      | 4.62                        | 5.31                          | 1951           | T    | T                 | 1955#           |      |              | 6                                          |              |                     |  |  |  | A    |       |
| S                           |                  |               |         |                |      |               |      | 1.89                        | 4.00                          | 1923           | T    | T                 | 1952#           |      |              | 3                                          |              |                     |  |  |  | S    |       |
| O                           |                  |               |         |                |      |               |      | 1.64                        | 3.37                          | 1940           | 0.2  | 6.0               | 1949            |      |              | 2                                          |              |                     |  |  |  | N    |       |
| N                           |                  |               |         |                |      |               |      | 1.47                        | 2.53                          | 1930           | 2.4  | 30.0              | 1952            |      |              | 2                                          |              |                     |  |  |  | O    |       |
| D                           |                  |               |         |                |      |               |      | 3.31                        | 5.03                          | 1926           | 8.8  | 51.0              | 1915            |      |              | 3                                          |              |                     |  |  |  | D    |       |
| Year                        |                  |               |         |                |      |               |      | 27.73                       | 5.31                          | Aug. 1951      | 46.6 | 52.0              | Feb. 1932       |      |              | 37                                         |              |                     |  |  |  | Year |       |

(a) Average length of record, years.

T Trace, an amount too small to measure.

\*\* Base 65°F.

# Also on earlier dates, months, or years.

\* Less than one half.

STATION HISTORY

| Observer             | Dates       | Direction and Distance of Station from Post Office | Elevation (feet) | Station known as |
|----------------------|-------------|----------------------------------------------------|------------------|------------------|
| U. S. Forest Service | Dec. 1914 - | 0.5 mi. W                                          | 6000             | Crown King       |

The weather records summarized in this publication were made available through the cooperation and interest of the U. S. Forest Service.

AVERAGE MONTHLY TEMPERATURES (°F) FOR CROWN KING, ARIZONA

| Year                                     | Jan. | Feb.  | Mar. | Apr. | May  | June | July | Aug. | Sep. | Oct. | Nov.  | Dec.  | Annual |
|------------------------------------------|------|-------|------|------|------|------|------|------|------|------|-------|-------|--------|
| 1915                                     |      | 43.6* |      | 54.5 | 58.0 | 70.6 | 75.0 | 75.1 | 65.7 |      |       | 42.7  |        |
| 1916                                     |      |       | 51.7 |      | 63.8 | 70.5 | 77.0 | 72.6 | 68.4 | 52.7 | 44.1* | 37.3  |        |
| 1917                                     | 34.1 | 38.9  | 40.0 | 49.2 | 52.5 | 72.4 | 74.7 | 70.3 | 66.7 | 57.8 | 48.0  | 45.6* | 54.2   |
| 1918                                     | 34.0 | 36.9  | 42.9 | 52.8 | 58.7 | 71.8 | 71.6 | 66.5 | 61.4 | 53.2 |       |       |        |
| no temperature record after October 1918 |      |       |      |      |      |      |      |      |      |      |       |       |        |

\* average temperature missing on one through five days during the month

TOTAL PRECIPITATION (INCHES) FOR CROWN KING, ARIZONA

| Year | Jan.  | Feb.  | Mar. | Apr. | May  | June | July | Aug.  | Sep. | Oct. | Nov. | Dec.  | Annual |
|------|-------|-------|------|------|------|------|------|-------|------|------|------|-------|--------|
| 1915 | 7.28  | 5.08  | 1.48 | 4.59 | 1.26 | 0.58 | 4.91 | 2.66  | 2.12 | 0.10 | 1.70 | 5.25  | 37.01  |
| 1916 |       | 2.08  | 4.58 | 0.59 | 0.30 | 0.00 | 3.42 | 4.07  | 3.19 | 5.58 | 0.60 | 2.10  |        |
| 1917 | 5.49  | 2.90  | 0.50 | 9.42 | 2.40 | T    | 5.37 | 2.15  | 1.01 | T    | T    | 0.00  | 29.22  |
| 1918 | 4.42  | 2.07  | 5.64 | 0.70 | 0.12 | 2.59 | 2.06 | 9.40  | 0.66 | 0.89 |      |       |        |
| 1919 |       |       |      |      | 0.60 | 0.00 | 7.62 | 2.35  | 1.01 | 2.04 | 6.31 | 0.06  |        |
| 1920 | 3.87  | 5.20  | 2.70 | 0.50 | 0.86 | 0.00 | 3.00 | 3.22  | 1.34 | 3.00 | 0.35 | 0.70  | 24.74  |
| 1921 | 2.00  | 1.50  | 2.40 | 1.80 | 1.53 | 0.00 | 7.55 | 7.40  | 0.50 | 2.50 | 0.20 | 7.80  | 35.18  |
| 1922 | 9.30  | 1.60  | 3.50 | 0.85 | 1.00 | 0.54 | 4.80 | 4.10  | 1.02 | 1.00 | 0.65 | 0.80  | 29.16  |
| 1923 | 1.90  | 6.70  | 4.55 | 0.00 |      | 0.02 | 4.39 | 5.97  | 5.80 | 1.00 |      |       |        |
| 1924 |       |       | 3.05 | 2.00 |      | 0.30 |      |       |      |      | 0.30 | 6.55  |        |
| 1925 | 0.33  | 0.48  | 1.16 | 3.75 | 0.07 | 1.69 | 4.57 | 2.24  | 3.20 | 4.80 | 1.15 | 0.85  | 24.29  |
| 1926 | 0.83  | 1.50  | 1.84 | 9.00 | 0.14 | 0.18 | 1.10 | 1.31  | 1.45 | 1.31 |      | 11.53 |        |
| 1927 |       |       |      | 2.26 | 0.00 | 0.50 | 1.38 | 11.50 | 5.73 | 3.05 | 0.00 | 5.71  |        |
| 1928 | 0.73  | 3.20  | 0.56 | 0.38 |      | 0.00 | 2.49 | 2.78  | 1.23 | 1.58 | 1.00 | 3.15  |        |
| 1929 | 1.89  | 2.87  | 1.58 | 1.83 | 0.02 | 0.00 | 2.59 | 5.31  | 2.27 | 0.90 | 0.12 | 0.00  | 19.38  |
| 1930 | 5.98  | 1.03  | 5.71 | 1.16 | 1.66 | 0.68 | 6.74 | 5.06  | 2.15 | 1.17 | 5.19 | 0.00  | 36.53  |
| 1931 | 1.11  | 7.50  | 0.67 | 1.17 | 0.37 | 1.00 | 6.96 | 0.76  | 1.67 | 4.13 | 4.49 |       |        |
| 1932 | 1.37  | 10.25 | 0.12 | 0.68 | 0.11 | 2.51 | 4.31 | 2.90  | 1.53 | 2.76 | 0.00 | 5.51  | 32.05  |
| 1933 | 4.60  | 0.64  | T    | 1.83 | 0.55 | 0.34 | 2.03 | 1.20  | 2.29 | 1.81 | 2.58 | 0.45  | 18.32  |
| 1934 | 0.34  | 1.43  | 0.32 | 1.08 | 1.01 | 0.12 | 1.67 | 3.65  | 0.64 | T    | 3.37 | 4.18  | 17.81  |
| 1935 | 5.83  | 5.04  | 4.09 | 1.66 | 0.00 | 0.00 | 0.85 | 4.50  | 1.45 | T    | 0.03 | 0.00  | 23.45  |
| 1936 | 0.45  | 2.44  | 1.30 |      | T    | 0.34 | 2.66 | 5.57  | 2.52 | 1.08 | 0.58 | 4.36  |        |
| 1937 | 1.72  | 1.05  | 1.45 | 0.45 | 1.55 | 0.58 | 3.23 | 4.25  | 2.43 | 0.00 | 0.24 | 2.97  | 19.92  |
| 1938 | 1.73  | 3.43  | 4.49 | 0.20 | T    | 0.83 | 1.71 | 2.39  | 0.19 | 0.00 | T    | 7.50  | 22.47  |
| 1939 | 2.63  | 2.30  | 2.16 | 0.50 | T    | 0.00 | 2.20 | 4.22  | 6.67 | 0.00 | 3.45 | 0.20  | 24.33  |
| 1940 | 1.09  | 3.72  | T    | 2.45 | 1.26 | 0.64 | 0.29 | 4.11  | 3.48 | 4.55 | 1.49 | 6.05  | 29.13  |
| 1941 | 4.65  | 4.80  | 6.91 | 8.09 | 0.23 | 0.00 | 2.64 | 3.12  | 1.41 | 4.69 | 1.24 | 4.10  | 41.88  |
| 1942 | 1.49  | 1.83  | 0.73 | 1.54 | 0.00 | 0.00 | 1.92 | 5.84  | 0.19 | 0.69 | 0.02 | 1.91  | 16.16  |
| 1943 | 4.73  | 1.77  | 3.24 | 0.80 | 0.06 | 0.05 | 1.37 | 5.35  | 5.46 | 1.56 | 0.00 | 2.25  | 26.64  |
| 1944 | 1.27  | 7.54  | 2.17 | 1.64 | 1.21 | 0.00 | 0.25 | 1.10  | 1.95 | 0.97 | 5.01 | 4.15  | 27.26  |
| 1945 | 4.08  | 1.57  | 6.87 | 0.17 | 0.00 | 0.00 | 2.82 | 2.45  | 1.46 | 2.58 | 0.00 | 4.76  | 26.76  |
| 1946 | 1.40  | 0.10  | 0.62 | 2.46 | 0.10 | T    | 3.61 | 5.92  | 4.29 | 1.21 | 3.56 | 2.91  | 26.38  |
| 1947 | 0.39  | 0.90  | 0.03 | 0.02 | 1.61 | T    | 0.66 | 6.98  | 0.30 | 0.41 | 1.23 | 4.41  | 16.94  |
| 1948 | 0.27  | 2.55  | 1.72 |      |      | 0.46 | 4.14 | 9.35  | 0.17 | 3.46 | T    | 7.76  |        |
| 1949 | 12.50 | 1.76  | 2.22 | 1.24 | 0.27 | 0.98 | 3.80 | 1.56  | 4.09 | 3.62 |      | 3.51  |        |
| 1950 | 2.05  | 2.78  | 1.76 | 0.16 | 0.22 | 0.06 | 5.48 | 0.52  | 1.98 | T    | 0.86 | 0.00  | 15.87  |
| 1951 | 4.85  | 2.50  | 2.65 | 3.00 | 0.99 | 0.00 | 4.10 | 16.95 | 0.00 | 1.86 | 1.88 |       |        |
| 1952 |       | 0.52  |      | 2.53 | 0.02 | 0.18 | 1.51 | 7.91  | 1.61 | 0.00 | 4.25 | 3.00  |        |
| 1953 | 0.50  | 1.39  | 0.71 | 0.63 | 0.56 | 0.00 | 8.59 | 6.31  | T    | T    | 0.64 |       |        |
| 1954 | 4.77  | 1.85  | 8.10 | T    | 0.30 | 0.75 | 4.33 | 2.51  | 1.81 | 1.07 | T    | 0.38  | 25.87  |
| 1955 | 5.29  | 0.55  | 0.23 | 0.58 | 0.13 | 1.76 | 6.95 | 5.90  | 0.00 | 0.73 | 2.03 | 2.09  | 26.24  |
| 1956 | 0.56  | 1.53  | 0.00 | 0.30 | 0.02 | 1.72 | 8.45 | 2.36  | T    | 1.10 | 0.00 | 0.29  | 16.33  |
| 1957 | 10.55 | 1.95  | 1.14 | 1.06 | 1.61 | 1.09 | 1.86 | 3.16  | 0.00 | 4.07 | 3.83 | 1.51  | 31.63  |
| 1958 | 0.22  | 5.04  | 4.70 | 2.00 | 1.36 | 1.00 | 0.76 | 9.71  | 6.61 | 1.40 | 1.06 | 0.00  | 33.66  |
| 1959 | 1.13  | 3.75  | 0.00 | 1.00 | 0.73 | 0.09 | 5.99 | 4.63  | 0.11 | 3.77 | 0.49 | 10.47 | 32.16  |
| 1960 | 2.28  | 1.87  |      |      |      |      |      |       |      |      |      |       |        |

This climatological summary has been made possible by a cooperative agreement between the University of Arizona and the United States Weather Bureau. Under the terms of this agreement the Institute of Atmospheric Physics of the University of Arizona has put on IBM punched cards all available daily weather data for the years prior to 1948 for over 100 observation stations in Arizona. In turn, the Weather Bureau has reproduced for the Institute, without charge, cards containing similar, but more recent, information which it has routinely punched since 1948. From these daily cards the Institute has produced, for all stations, summary cards which contain average weather data for each five-day period and each month of record. All of these decks of IBM punched cards are available for research work on request.

Copies of this climatological summary can be obtained from the Institute of Atmospheric Physics, University of Arizona, Tucson 25, Arizona.



INSTITUTE OF ATMOSPHERIC PHYSICS, UNIVERSITY OF ARIZONA,  
AND THE U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU,  
CLIMATOGRAPHY OF THE UNITED STATES NO. 20-2

LATITUDE: 34° 45'  
LONGITUDE: 112° 07'  
ELEV. (GROUND): 5245 feet

CLIMATOLOGICAL SUMMARY

STATION: JEROME

STATION NO. 02-4453-3

MEANS AND EXTREMES FOR PERIOD 1898 - 1957

| Month | Temperature (°F) |               |         |                |            |               |           |      | Precipitation Totals (inches) |      |                |      |                   |           | Estimated mean relative humidity (percent) |          | Mean number of days |                         |               |               |              | Month |  |
|-------|------------------|---------------|---------|----------------|------------|---------------|-----------|------|-------------------------------|------|----------------|------|-------------------|-----------|--------------------------------------------|----------|---------------------|-------------------------|---------------|---------------|--------------|-------|--|
|       | Means            |               |         |                | Extremes   |               |           |      | Estimated mean degree days**  | Mean | Greatest daily | Year | Snow, Sleet, Hail |           |                                            | 0000 MST | 1800 MST            | Precip. 10 inch or more | Temperatures  |               |              |       |  |
|       | Daily maximum    | Daily minimum | Monthly | Record highest | Year       | Record lowest | Year      | Mean |                               |      |                |      | Maximum monthly   | Year      | 90° and above                              |          |                     |                         | 32° and below | 32° and below | 0° and below |       |  |
|       |                  |               |         |                |            |               |           |      |                               |      |                |      |                   |           |                                            |          |                     |                         |               |               |              |       |  |
| (a)   | 57               | 56            | 56      | 57             | 57         | 56            | 56        |      | 59                            | 59   | 59             | 58   | 58                | 58        |                                            | 58       | 48                  | 48                      | 47            | 47            |              |       |  |
| J     | 50.9             | 32.5          | 41.7    | 75             | 1935       | 7             | 1913      | 722  | 1.86                          | 3.10 | 1915           | 7.0  | 45.5              | 1949      | 57                                         | 52       | 4                   | 0                       | *             | 15            | 0            | J     |  |
| F     | 54.5             | 34.7          | 44.6    | 82             | 1898       | 8             | 1933      | 571  | 1.80                          | 1.60 | 1901           | 4.6  | 39.0              | 1944      | 59                                         | 51       | 4                   | 0                       | *             | 10            | 0            | F     |  |
| M     | 60.7             | 38.7          | 49.7    | 85             | 1898       | 20            | 1952*     | 474  | 1.57                          | 2.31 | 1918           | 2.7  | 20.1              | 1909      | 52                                         | 39       | 4                   | 0                       | *             | 7             | 0            | M     |  |
| A     | 69.1             | 45.6          | 57.4    | 92             | 1898       | 23            | 1945      | 318  | 1.08                          | 2.65 | 1941           | 1.0  | 11.0              | 1941      | 48                                         | 34       | 3                   | *                       | 0             | 2             | 0            | A     |  |
| M     | 77.0             | 53.6          | 65.2    | 99             | 1910       | 26            | 1915      | 118  | 0.50                          | 1.40 | 1908           | 0.1  | 2.5               | 1922      | 43                                         | 29       | 1                   | 0                       | *             | 0             | 0            | M     |  |
| J     | 87.4             | 63.1          | 75.3    | 104            | 1936*      | 40            | 1934*     | 0    | 0.39                          | 1.61 | 1955           | T    | 0.2               | 1949      | 40                                         | 26       | 1                   | 13                      | 0             | 0             | 0            | J     |  |
| J     | 90.4             | 67.2          | 78.8    | 105            | 1898       | 50            | 1926      | 0    | 2.65                          | 2.45 | 1953           | T    | 0.4               | 1950      | 53                                         | 43       | 6                   | 18                      | 0             | 0             | 0            | J     |  |
| A     | 87.5             | 65.3          | 76.4    | 105            | 1933       | 50            | 1907      | 0    | 3.03                          | 2.40 | 1905           | T    | T                 | 1955*     | 62                                         | 45       | 7                   | 13                      | 0             | 0             | 0            | A     |  |
| S     | 84.1             | 61.3          | 72.7    | 102            | 1950       | 42            | 1936*     | 0    | 1.31                          | 2.40 | 1923           | T    | T                 | 1954      | 55                                         | 38       | 3                   | 6                       | 0             | 0             | 0            | S     |  |
| O     | 73.7             | 51.3          | 62.4    | 94             | 1934       | 27            | 1949      | 121  | 1.13                          | 2.45 | 1940           | T    | 0.7               | 1949      | 53                                         | 41       | 2                   | *                       | 0             | *             | 0            | O     |  |
| N     | 61.7             | 41.1          | 51.4    | 85             | 1934*      | 16            | 1931*     | 408  | 1.20                          | 3.73 | 1919           | 2.1  | 23.2              | 1905      | 52                                         | 47       | 2                   | 0                       | 0             | 4             | 0            | N     |  |
| D     | 52.8             | 34.4          | 43.6    | 75             | 1925       | 14            | 1949*     | 663  | 1.68                          | 2.30 | 1915           | 4.4  | 37.0              | 1915      | 60                                         | 55       | 4                   | 0                       | *             | 12            | 0            | D     |  |
| Year  | 70.6             | 49.1          | 59.9    | 105            | Aug. 1933* | 7             | Jan. 1913 | 3395 | 18.20                         | 3.73 | 1919           | 21.9 | 45.5              | Jan. 1949 | 53                                         | 42       | 41                  | 51                      | *             | 50            | 0            | Year  |  |

(a) Average length of record, years.

T Trace, an amount too small to measure.

\*\* Base 65° F.

# Also on earlier dates, months, or years.

\* Less than one half.

CLIMATE OF JEROME, ARIZONA

Jerome is in central Arizona in the Prescott National Forest. It is located on the steep east slopes of Woodchute Mountain at an elevation of very nearly one mile. The summit of this mountain reaches a height of 7834 feet about three miles west of the town. The summit of Mingus Mountain, about four miles to the south-southwest, is at 7743 feet. In the vicinity of the town, the terrain slopes downward rapidly toward the east to the Verde River, which flows in a general northwest to southeast direction. The floor of the Verde River Valley has an elevation of about 3700 feet about five miles east of Jerome. Both Woodchute and Mingus Mountain are part of the Black Hills range, which runs in a northwest to southeast direction just west of Jerome. To the west of this range, at a distance of about fifteen airline miles from Jerome, is the Chino Valley, which is also oriented in a general northwest to southeast direction. The floor of this valley is almost 1000 feet higher than that of the Verde Valley at the latitude of Jerome.

The terrain in the vicinity of Jerome has marked effects on its climate, particularly on the minimum temperatures. Other stations at a similar latitude and altitude normally record much lower temperatures than Jerome. This is because cold air normally flows down the steep slope away from the town during the night. Winter low temperatures are thus nearly the same as those recorded at stations in the desert regions in south-central Arizona. Daytime temperatures are at about the same level as those at other stations at a similar altitude and latitude in the state. Therefore, the town has summer temperatures that seldom require air-conditioning for comfort, combined with relatively mild winter temperatures.

Jerome, like many other Arizona stations, has two precipitation seasons during the average year. One of these comes during the summer, when moist tropical air from the Gulf of Mexico flows northwestward over the state. The other comes during the winter, when storms from the Pacific Ocean, that have entered the continent via southern California, spread moisture across Arizona. The summer rainfall season is the major one, and during the July to September thunderstorm season, it brings Jerome nearly forty percent of its total annual precipitation. Some of the winter moisture falls as snow, but this snow does not remain long on the ground, except in the mountains west and southwest of town.

Because of the mild winter and nighttime temperatures, Jerome has a frost-free season about fifty to sixty days longer than that at most other stations in Arizona at a comparable latitude. The average duration is about 233 days, extending from the first week in April through the middle of November.

Humidity is usually low and sunshine abundant throughout the year.

AVERAGE MONTHLY TEMPERATURES (°F) FOR JEROME, ARIZONA

| Year | Jan.  | Feb.  | Mar.  | Apr.  | May   | June  | July  | Aug.  | Sep.  | Oct.  | Nov.  | Dec.  | Annual |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1898 | 35.2  | 52.5  | 52.3  | 66.4  | 63.7  | 77.9  | 81.8  | 77.7  | 75.3  | 63.6  | 49.1  | 38.2  | 61.1   |
| 1899 | 39.9  | 43.6  | 50.6  | 60.7  | 63.1  | 75.7  | 79.9  | 76.9  | 78.4  | 58.5  | 52.6  | 45.1  | 60.4   |
| 1900 | 48.5  | 47.6  | 57.4  | 50.8  | 69.3  | 78.7  | 80.9  |       |       | 61.7  | 53.5  | 46.3  |        |
| 1901 | 44.1  | 44.7  | 50.3  | 57.0  | 67.1  | 76.0  | 84.2  | 81.0  | 74.7  | 63.8  | 55.0  | 46.0  | 62.0   |
| 1902 | 43.8  | 46.7  | 46.2  | 62.2  | 66.2  | 80.5  | 78.8  | 78.1  | 74.3  | 65.2  | 46.2  | 42.8  | 60.9   |
| 1903 | 43.2  | 38.2  | 50.2  | 57.1  | 65.7  | 76.4  | 79.5  | 79.8  | 68.9  | 63.5  | 56.0  | 45.6  | 60.3   |
| 1904 | 40.4  | 50.5  | 53.3  | 60.8  | 67.8  | 77.6  | 79.3  | 74.9  | 71.7  | 62.1  | 55.4  | 44.3  | 61.5   |
| 1905 | 44.9  | 43.3  | 50.0  | 54.8  | 61.6  | 75.9  | 80.7  | 78.4  | 72.6  | 62.1  | 48.1  | 39.4  | 59.3   |
| 1906 | 40.5  | 47.7  | 50.0  | 55.0  | 64.5  | 76.0  | 81.0  | 75.0  | 71.4  | 64.3  | 49.0  | 44.8  | 60.0   |
| 1907 | 41.0  | 51.2  | 51.2  | 59.6  | 63.7  | 73.4  | 80.1  | 75.7  | 73.5  | 59.7  | 49.8  | 46.0  | 60.4   |
| 1908 | 44.2  | 45.3  | 54.0  | 59.0  | 62.4  | 74.0  | 78.7  | 75.8  | 71.5  | 57.9  | 50.8  | 42.6  | 59.7   |
| 1909 | 45.2  | 44.1  | 46.7  | 58.2  | 64.3  | 77.1  | 78.6  | 72.3  | 70.0  | 65.1  | 53.3  | 36.2  | 59.3   |
| 1910 | 42.6  | 45.4  | 57.6  | 61.0  | 71.0  | 77.0  | 80.5  | 78.3  | 76.2  | 64.5  | 54.0  | 47.0  | 62.9   |
| 1911 | 45.6  | 41.6  | 54.0  | 58.4  | 65.5  | 74.8  | 74.9  | 77.4  | 72.5  | 60.7  | 50.3  | 39.0  | 59.6   |
| 1912 | 45.7  | 49.4  | 46.8  | 51.9  | 64.4  | 75.7  | 74.4  | 75.6  | 70.0  | 57.1  | 52.6  | 39.3  | 58.6   |
| 1913 | 38.4  | 41.1  | 47.3  | 57.4* |       | 73.0  | 77.2  |       | 71.0  |       |       | 40.3  |        |
| 1914 | 44.8  | 45.2  | 53.9  | 59.4  | 66.6  | 74.4  | 75.3  |       | 73.6* | 60.8* |       | 38.5  |        |
| 1915 | 39.5  | 42.9  | 49.6* | 55.9  | 58.2* | 74.3  | 76.8* | 78.9  | 70.0* |       | 51.2* | 42.4* |        |
| 1916 | 38.0* |       | 55.7  | 59.5* | 65.1* | 76.7  | 78.3  | 74.3* | 70.3* |       |       |       |        |
| 1917 | 37.3  | 42.8  | 46.1  |       | 57.3* | 74.9  |       | 76.6* | 72.2  | 66.6* | 57.8* | 52.7  |        |
| 1918 | 41.2  | 46.1  | 50.4  | 53.2  | 61.0* | 80.5  | 77.2  | 74.8  |       |       |       |       |        |
| 1919 |       | 39.6  | 46.3* | 60.3  | 66.8* | 77.2  | 75.4  | 76.0  | 70.8  | 55.9* | 48.0  | 45.0* |        |
| 1920 | 44.3* | 46.5* | 46.0* |       |       | 74.1* | 81.2* | 75.3* |       | 58.3* |       | 41.4  |        |
| 1921 | 42.7* | 47.1* | 54.5  |       |       | 75.5  | 78.1* | 74.8* | 73.4  | 64.3* | 56.1* | 45.5  |        |
| 1922 | 38.2* | 40.0  | 45.1  | 49.5* | 64.4  | 77.2  | 80.4* | 77.7  | 73.8  | 63.3  | 44.1  |       |        |
| 1923 | 45.4  | 40.6  | 45.5  | 54.3  | 67.9  |       |       | 74.4  |       | 68.5  | 49.6  | 42.0  |        |
| 1924 | 42.0  | 51.7  | 45.0  | 53.5  | 67.6  | 79.2  | 77.6  |       | 73.7  | 61.2  | 53.6  | 41.0  |        |
| 1925 | 42.3  | 49.0  | 53.0  | 57.8  | 72.2  | 73.5  |       |       |       |       | 52.4  | 45.1  |        |
| 1926 | 39.8  | 47.4  |       |       |       | 73.2  | 74.5  | 76.2  | 73.0  | 65.3  | 54.5  | 39.7* |        |
| 1927 | 46.8  |       |       | 57.2* | 66.4  | 74.5  | 81.6* | 73.9  | 69.1  | 65.3  | 55.9  | 37.9  |        |
| 1928 | 45.6  | 47.9* | 58.9  |       |       | 75.2  | 79.9  | 76.1  |       |       | 50.3  | 42.9  |        |
| 1929 | 39.5  | 40.2  | 49.0  | 54.3  | 65.9  | 76.5  | 77.0  | 76.3  | 72.1  | 62.3* | 46.2* | 50.6* | 59.3   |
| 1930 | 38.4  | 51.3  | 49.1  | 62.8  |       | 77.7  | 77.2  | 76.7  | 71.0  | 61.8  | 50.4* | 44.6  |        |
| 1931 | 44.9  | 44.0  |       | 60.3* | 68.4  | 75.8  | 82.2* | 76.8  | 73.3  | 63.8  | 45.9* | 40.7  |        |
| 1932 | 36.7* | 45.1  | 50.1  | 58.7  | 65.2  | 75.1* | 79.0* | 79.0  | 76.6  | 61.9  | 58.1  | 39.0  | 60.4   |
| 1933 | 39.8* | 35.5* | 47.7* | 51.2  | 60.2  | 76.8  | 81.7  | 79.2  | 75.8  | 67.4  | 57.0  | 50.0  | 60.2   |
| 1934 | 47.5  |       | 60.8  | 63.4  | 71.0  | 71.5  | 81.3  | 76.7  | 73.5* | 67.9  | 53.4  | 47.9  |        |
| 1935 | 43.6  | 46.8  | 47.9  | 57.3  | 61.1  | 79.5  | 79.4  | 76.7* | 73.4  | 63.8* | 51.0  | 45.5  | 60.5   |
| 1936 | 44.9  | 44.0  | 52.8  | 63.0  | 71.2  | 79.9  | 80.7  | 78.1* | 71.9* | 61.2* | 53.1  | 43.5  | 62.0   |
| 1937 | 29.9* | 42.7  | 47.6  | 58.9  | 69.5  | 75.2* | 79.0* | 79.4* | 75.2* | 67.3  | 55.6* | 47.1* | 60.6   |
| 1938 | 46.7  | 44.8  | 47.0  | 59.3* | 75.2  | 75.2  | 79.4* | 76.8  | 73.8* | 61.5  | 47.1  | 45.6  |        |
| 1939 | 39.7  | 33.8  | 50.9  | 59.2  | 67.5  | 75.5* | 80.5  | 77.3  | 69.4  | 60.8  | 52.9  | 49.8  | 59.8   |
| 1940 | 42.7  | 42.8  | 52.7* | 57.1  | 69.6  | 77.8  | 81.2* | 77.3* | 68.3  | 62.4* | 46.9* | 44.8  | 60.3   |
| 1941 | 40.2  | 44.7  | 47.9* | 48.8  | 64.6* | 71.3* | 78.2* | 74.9  | 68.8  | 54.7  | 52.1  | 40.7  | 57.2   |
| 1942 | 43.3  | 40.0  | 46.5  | 54.4  | 64.1* | 74.7  | 81.5  | 76.9  | 73.1  |       | 54.2* | 46.1  |        |
| 1943 | 41.9  | 47.0  | 50.9  | 60.0  | 67.1  | 71.5  | 79.3* | 74.8  | 73.9  | 62.1  | 53.1  | 41.1  | 60.2   |
| 1944 | 40.1  | 39.4  | 45.1  | 50.9  | 62.3  | 69.8* | 78.4* | 79.4  | 72.4  | 63.1* | 44.7* | 43.3* | 57.4   |
| 1945 | 41.6  | 43.5  | 42.1  | 53.9  | 63.8  | 71.2  | 79.2  | 75.3  | 73.2  | 62.6  | 50.6  | 39.4  | 58.0   |
| 1946 | 39.1  | 42.7* | 49.5  | 60.8  | 64.0  | 77.8  | 77.9  | 75.3  | 72.6  | 57.4  | 46.0  | 47.5  | 59.2   |
| 1947 | 39.7  | 50.5  | 52.0  | 57.4  | 68.3  | 71.6  | 79.4  | 74.1  | 75.1* | 63.0  | 45.1* | 40.3  | 59.7   |
| 1948 | 45.6* |       | 41.6  | 58.4  |       | 73.4  | 79.1  | 75.8  | 74.1* | 62.6  | 47.7  | 41.6  |        |
| 1949 | 30.0  | 38.8  | 47.7  | 60.5  | 63.4  | 72.2  | 77.7* | 76.7  | 74.2  | 58.2  | 59.9  | 41.5  | 58.4   |
| 1950 | 40.0  | 48.7  | 51.5  | 62.0  | 64.2  | 74.8  | 75.6  | 76.3  | 70.2  | 69.6  | 56.9  | 52.1  | 61.8   |
| 1951 | 42.6  | 43.6  | 48.5  | 54.9  | 64.3  | 73.0* | 80.6* | 75.3  | 74.2  | 61.3  | 48.3  | 40.0  | 58.9   |
| 1952 | 39.5  | 43.0  | 41.0  | 55.8  | 67.8  | 72.5  | 77.4  | 77.6  | 74.0  | 69.1* | 46.0  | 40.9  | 58.7   |
| 1953 | 47.3  | 45.1  | 50.8  | 56.2  | 68.5  | 74.7  | 78.2* | 79.8  | 75.2  | 62.3  | 53.2  | 42.3  | 60.0   |
| 1954 | 42.5  | 51.4  | 46.8  | 62.1  | 67.1  | 72.6  | 76.1  | 74.1  | 72.3* | 64.5  | 56.4  | 44.5  | 61.0   |
| 1955 | 37.1  | 38.5  | 48.9* | 54.7  | 61.8  |       | 74.0  | 73.2  | 72.1  | 66.4  | 51.6  | 46.7  |        |
| 1956 | 46.5  | 39.6  | 52.2* | 54.4  | 66.9  | 77.4  | 76.5  | 75.0  | 77.0  | 61.0  | 49.4  | 44.5  | 60.0   |
| 1957 | 40.2  | 49.3  | 48.3  | 53.4  | 58.7  | 74.3  | 77.4  | 73.4  | 71.9  | 56.9  | 44.4  | 46.4  | 57.9   |
| 1958 | 42.3  | 46.2  | 41.6  | 54.0  | 69.2  | 75.0  | 79.1  | 76.9  | 69.7  | 62.0  | 49.6  | 49.9  | 59.6   |
| 1959 | 44.2  | 40.7  | 51.2  | 59.5* | 62.6  | 76.8  | 78.7  | 72.9  | 70.6  | 61.9  | 50.3  | 44.0  | 59.4   |
| 1960 | 35.6  | 38.9  | 52.6  |       |       |       |       |       |       |       |       |       |        |

\* average temperature missing on one through five days during the month.



## TOTAL PRECIPITATION (INCHES) FOR JEROME, ARIZONA

| Year | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| 1898 | 1.62 | 0.15 | T    | 0.45 | 1.10 | 0.70 | 2.00 | 3.80 | 0.00 | 0.00 | 0.70 | 2.60 | 13.32  |
| 1899 | 1.40 | 1.00 | 0.00 | T    | 0.00 | 0.20 | 1.90 | 0.60 | 0.10 | 2.05 | 0.11 | 0.50 | 7.86   |
| 1900 | 0.20 | T    | 0.05 | 3.00 | 0.03 | 0.00 | 1.30 |      |      | 1.30 | 2.10 | 0.00 |        |
| 1901 | 1.10 | 5.61 | 0.50 | 0.30 | 0.70 | 0.00 | 0.80 | 2.20 | 0.00 | 2.30 | 0.70 | 0.00 | 14.21  |
| 1902 | 1.35 | 1.30 | 1.50 | 0.20 | 0.40 | T    | 1.20 | 3.90 | 0.20 | 0.00 | 3.00 | 1.00 | 14.05  |
| 1903 | 0.50 | 0.46 | 0.95 | 0.90 | 0.90 | 0.40 | 2.90 | 1.20 | 4.60 | 0.20 | 0.00 | 0.00 | 12.99  |
| 1904 | 0.62 | 6.00 | 0.50 | T    | 0.50 | T    | 2.30 | 7.40 | 0.20 | T    | 0.00 | 0.60 | 12.32  |
| 1905 | 5.10 | 7.80 | 7.30 | 7.70 | 0.90 | T    | 2.60 | 4.90 | 3.60 | 0.20 | 8.25 | 1.07 | 45.38  |
| 1906 | 0.55 | 1.90 | 4.10 | 1.60 | 0.30 | 0.00 | 1.00 | 4.20 | T    | T    | 2.90 | 4.20 | 20.75  |
| 1907 | 2.60 | 1.70 | 2.70 | 1.90 | 0.60 | 0.20 | 2.30 | 3.30 | 0.30 | 5.40 | 0.60 | T    | 21.60  |
| 1908 | 1.60 | 3.40 | 1.40 | 0.60 | 1.60 | 0.00 | 4.90 | 1.98 | 0.50 | 1.20 | 0.28 | 6.06 | 23.92  |
| 1909 | 1.84 | 1.90 | 2.08 | 0.15 | 0.07 | 0.20 | 3.72 | 6.04 | 1.26 | 0.00 | 1.21 | 1.88 | 20.35  |
| 1910 | 4.89 | 0.24 | 2.48 | 0.43 | 0.00 | 0.61 | 1.62 | 2.54 | 0.19 | 0.81 | 2.68 | 0.97 | 17.46  |
| 1911 | 3.48 | 2.47 | 3.11 | 0.15 | 0.66 | 1.01 | 6.50 | 5.32 | 1.99 | 2.52 | 0.00 | 0.10 | 26.71  |
| 1912 | T    | T    | 4.92 | 2.37 | 0.35 | 0.39 | 5.79 | 1.36 | T    | 3.61 | 0.12 | 1.88 | 20.79  |
| 1913 | 0.70 | 4.40 | 1.09 | T    | 0.00 | 0.17 | 3.25 | 2.89 | 2.38 | 0.53 | 3.18 | 1.74 | 20.66  |
| 1914 | 3.22 | 2.56 | 0.65 | 0.41 | 0.77 | 1.65 | 2.82 | 1.30 | 1.07 | 2.80 | 0.92 | 2.70 | 21.07  |
| 1915 | 4.98 | 3.68 | 0.93 | 3.35 | 1.12 | 0.51 | 2.44 | 1.87 | 0.48 | 0.25 | 1.21 | 5.86 | 26.68  |
| 1916 | 7.09 | 1.29 | 2.52 | 0.31 | 0.00 | 0.00 | 4.07 | 1.75 | 1.79 |      |      |      |        |
| 1917 | 2.96 | 1.13 | 0.29 | 4.42 | 1.30 | 0.00 | 4.07 | 4.07 | 1.60 | 0.04 | 0.00 | 0.00 | 19.68  |
| 1918 | 2.03 | 1.35 | 5.40 | 0.26 | 0.20 | 0.29 | 2.50 | 2.63 | 0.63 | 0.63 |      |      |        |
| 1919 | 0.60 | 2.41 | 1.41 | 0.79 | 0.72 | 0.08 | 8.63 | 2.76 | 3.86 | 2.24 | 5.24 | 0.03 | 28.77  |
| 1920 | 3.71 | 5.10 | 1.56 | 0.02 | 0.64 | T    | 1.45 | 2.37 | 0.59 | 2.18 | 0.14 | 0.28 | 18.04  |
| 1921 | 1.11 | 0.15 | 1.22 | 0.50 | 1.02 | 0.20 | 6.34 | 4.14 | 0.23 | 0.44 | 0.61 | 2.99 | 18.95  |
| 1922 | 2.90 | 1.12 | 3.10 | 0.78 | 1.05 | 1.20 | 0.70 | 2.07 | 1.57 | 0.70 | 2.66 | 0.46 | 18.31  |
| 1923 | 1.65 | 0.30 | 1.20 | 0.80 | 0.19 | T    | 3.05 | 4.64 | 3.47 | 0.34 | 1.95 | 2.68 | 20.47  |
| 1924 | 0.10 | 0.00 | 1.40 | 1.18 | 0.01 | 0.56 | 2.04 | 1.00 | 1.71 | 1.30 | 0.48 | 3.34 | 13.12  |
| 1925 | 0.30 | 0.72 | 0.80 | 2.36 | 0.00 | 1.23 | 2.58 | 3.11 | 3.07 | 0.82 | 0.89 |      |        |
| 1926 | 0.82 | 1.16 | 1.39 |      |      | 1.00 | 1.19 | 0.61 | 1.98 | 0.20 | 1.00 | 5.84 |        |
| 1927 | 1.16 | 4.66 | 0.51 | 0.80 | 0.40 | 0.71 | 0.31 | 3.09 | 4.51 | 1.67 | 0.15 | 1.84 | 19.61  |
| 1928 | 0.38 | 2.47 | 0.18 | 0.25 | 0.72 | 0.13 | 2.91 | 1.76 | 0.41 | 2.03 | 1.36 | 2.15 | 14.15  |
| 1929 | 1.37 | 0.90 | 0.95 | 1.00 | 0.04 | 0.05 | 2.73 | 2.27 | 1.25 | T    | 0.01 | T    | 10.57  |
| 1930 | 2.72 | 0.68 | 2.21 | 0.25 | 0.95 | 0.42 | 4.38 | 4.47 | 1.37 | 0.43 | 1.33 | T    | 19.21  |
| 1931 | 0.34 | 3.79 | 0.12 | 1.25 | 0.12 | 0.25 | 2.47 | 3.01 | 1.17 | 1.01 | 2.50 | 2.39 | 18.42  |
| 1932 | 1.03 | 5.16 | 0.31 | 0.78 | 0.63 | 0.82 | 2.17 | 1.24 | 0.85 | 1.69 | 0.00 | 1.89 | 16.57  |
| 1933 | 2.51 | 0.35 | T    | 1.19 | 0.54 | 0.14 | 1.94 | 1.56 | 1.61 | 0.50 | 1.77 | 0.66 | 12.77  |
| 1934 | 0.73 | 0.73 | 0.27 | 1.49 | 1.75 | 0.12 | 1.53 | 3.16 | 0.17 | T    | 0.67 | 2.18 | 12.80  |
| 1935 | 3.30 | 2.44 | 1.60 | 0.93 | 0.61 | T    | 4.87 | 2.42 | 1.62 | 0.30 | 1.07 | 0.70 | 19.86  |
| 1936 | 0.46 | 2.95 | 1.13 | 0.08 | 0.14 | 0.19 | 2.23 | 3.62 | 1.38 | 1.66 | 0.77 | 1.96 | 16.57  |
| 1937 | 2.63 | 4.35 | 2.50 | 0.11 | 0.39 | 0.97 | 0.60 | 1.07 | 0.86 | 0.00 | T    | 1.62 | 15.10  |
| 1938 | 0.91 | 2.20 | 3.81 | 0.30 | 0.05 | 0.82 | 1.87 | 4.61 | 2.28 | 0.02 | 0.02 | 3.06 | 19.95  |
| 1939 | 0.99 | 1.74 | 1.49 | 0.64 | T    | T    | 0.56 | 2.61 | 2.79 | 0.17 | 1.34 | 0.08 | 12.61  |
| 1940 | 1.48 | 1.58 | 0.10 | 1.74 | 0.21 | 1.79 | 0.05 | 4.53 | 4.37 | 3.54 | 1.50 | 3.61 | 24.60  |
| 1941 | 2.83 | 3.13 | 3.52 | 6.10 | 0.61 | 0.11 | 1.88 | 3.04 | 1.82 | 4.44 | 0.78 | 2.48 | 30.74  |
| 1942 | 0.49 | 1.23 | 0.60 | 1.48 | 0.00 | 0.00 | 0.88 | 0.80 | 0.41 | 0.50 | 0.10 | 1.32 | 7.81   |
| 1943 | 2.71 | 1.27 | 2.07 | 1.16 | 0.01 | 0.06 | 0.32 | 3.64 | 1.93 | 1.10 | 0.00 | 3.35 | 17.62  |
| 1944 | 1.61 | 4.48 | 1.44 | 2.02 | 1.43 | T    | 1.08 | 1.65 | 1.27 | 0.36 | 1.96 | 1.97 | 19.33  |
| 1945 | 2.26 | 0.85 | 2.93 | 0.25 | T    | T    | 3.22 | 4.16 | 0.12 | 1.13 | 0.00 | 2.62 | 17.54  |
| 1946 | 1.49 | 0.22 | 0.87 | 2.52 | 0.35 | 0.00 | 2.73 | 3.71 | 1.60 | 0.72 | 2.36 | 1.38 | 17.95  |
| 1947 | 0.35 | 0.32 | T    | T    | 0.67 | 0.05 | 1.23 | 4.42 | 1.18 | 0.92 | 1.61 | 2.76 | 13.51  |
| 1948 | 0.22 | 1.55 | 1.79 | 0.19 | 0.00 | 0.20 | 1.51 | 3.13 | 0.42 | 1.32 | 0.03 | 2.44 | 12.30  |
| 1949 | 5.69 | 0.59 | 1.09 | 0.60 | 0.20 | 1.24 | 2.40 | 1.85 | 1.58 | 2.07 | 0.89 | 1.33 | 19.43  |
| 1950 | 1.03 | 1.09 | 0.63 | 0.01 | 0.29 | T    | 5.04 | 1.04 | 0.63 | 0.03 | 0.13 | T    | 10.92  |
| 1951 | 1.43 | 0.43 | 0.44 | 2.48 | 0.82 | 0.00 | 1.16 | 6.28 | 0.27 | 2.12 | 1.10 | 3.43 | 19.96  |
| 1952 | 2.42 | 0.37 | 2.21 | 2.60 | 0.01 | 0.16 | 1.20 | 1.29 | 1.91 | 0.00 | 2.30 | 1.68 | 16.15  |
| 1953 | 0.25 | 0.38 | 1.03 | 1.15 | 0.20 | 0.00 | 6.88 | 2.53 | T    | 0.00 | 0.87 | 0.16 | 13.55  |
| 1954 | 2.61 | 1.35 | 4.04 | 0.10 | 1.02 | 0.23 | 5.34 | 3.92 | 1.60 | 0.72 | 0.06 | 0.29 | 21.28  |
| 1955 | 2.30 | 0.70 | 0.29 | 0.49 | 0.17 | 1.92 | 4.33 | 6.92 | 0.00 | 0.33 | 1.06 | 1.16 | 19.67  |
| 1956 | 0.77 | 0.32 | 0.00 | 0.35 | 0.02 | 1.25 | 1.84 | 0.80 | 0.00 | 0.41 | 0.00 | 0.35 | 6.11   |
| 1957 | 4.15 | 1.24 | 1.53 | 0.50 | 1.93 | 1.07 | 4.02 | 4.59 | 0.14 | 3.02 | 2.95 | 0.73 | 25.87  |
| 1958 | 0.33 | 3.10 | 3.58 | 1.37 | 0.68 | 1.48 | 1.46 | 3.24 | 4.80 | 0.61 | 1.14 | T    | 21.79  |
| 1959 | 0.31 | 2.51 | 0.10 | 1.03 | 0.92 | 0.17 | 2.77 | 2.20 | 0.14 | 1.56 | 0.58 | 4.17 | 16.46  |
| 1960 | 1.43 | 1.74 | 1.33 |      |      |      |      |      |      |      |      |      |        |

# STATION HISTORY

| Observers                | Dates                  | Direction and Distance of Station from Post Office | Elevation (feet) | Station known as |
|--------------------------|------------------------|----------------------------------------------------|------------------|------------------|
| Dr. L. A. Hawkins        | Jan. 1898 - about 1906 | Probably inside Jerome                             | 5400             | Jerome           |
| Dr. L. A. Hawkins        | about 1906 - Feb. 1917 | Probably inside Jerome                             | 5250             | "                |
| United Verde Copper Co.  | Mar. 1917 - Apr. 1926  | Inside Jerome                                      | "                | "                |
| United Verde Copper Co.* | May 1926 - July 1953   | 3/8 mi. NW                                         | "                | "                |
| Mrs. Harry Mader         | Aug. 1953 -            | 500 ft. S                                          | 5245             | "                |

\* Paul F. Yates served for various periods from Nov. 1933 to July 1953.

The weather records summarized in this publication were made available through the commendable civic spirit and interest of the above listed observers and organizations.

Relative humidity readings have not been taken at this location. The values given in the Climatological Summary Table were estimated by a method devised at the Institute of Atmospheric Physics.

This climatological summary has been made possible by a cooperative agreement between the University of Arizona and the United States Weather Bureau. Under the terms of this agreement the Institute of Atmospheric Physics of the University of Arizona has put on IBM punched cards all available daily weather data for the years prior to 1948 for over 100 observation stations in Arizona. In turn, the Weather Bureau has reproduced for the Institute, without charge, cards containing similar, but more recent, information which it has routinely punched since 1948. From these daily cards the Institute has produced, for all stations, summary cards which contain average weather data for each five-day period and each month of record. All of these decks of IBM punched cards are available for research work on request.

Copies of this climatological summary can be obtained from the Institute of Atmospheric Physics, University of Arizona, Tucson 25, Arizona.



INSTITUTE OF ATMOSPHERIC PHYSICS, UNIVERSITY OF ARIZONA,  
AND THE U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU,  
CLIMATOGRAPHY OF THE UNITED STATES NO. 20-2

LATITUDE 34° 21'  
LONGITUDE 111° 58'  
ELEV. (GROUND) 4000 feet

CLIMATOLOGICAL SUMMARY

STATION SYCAMORE RANGER  
STATION  
STATION NO 02-8391-1

MEANS AND EXTREMES FOR PERIOD 1920 - 1957

| Month | Temperature (F) |               |         |                |      |               |      | Estimated mean degree days** | Precipitation Totals, inches |                |           |                 |                 |           | Estimated mean relative humidity percent† |       | Mean number of days       |              |              |              |             | Month |      |
|-------|-----------------|---------------|---------|----------------|------|---------------|------|------------------------------|------------------------------|----------------|-----------|-----------------|-----------------|-----------|-------------------------------------------|-------|---------------------------|--------------|--------------|--------------|-------------|-------|------|
|       | Means           |               |         | Extremes       |      |               |      |                              | Mean                         | Greatest daily | Year      | Snow Sleet Hail |                 |           | 65-85                                     | 85-95 | Temperatures              |              |              |              |             |       |      |
|       | Daily maximum   | Daily minimum | Monthly | Record highest | Year | Record lowest | Year |                              |                              |                |           | Mean            | Maximum monthly | Year      |                                           |       | Precip. 10 inches or more | 50 and above | 32 and below | 32 and below | 0 and below |       |      |
|       |                 |               |         |                |      |               |      |                              |                              |                |           |                 |                 |           |                                           |       |                           |              |              |              |             |       | Max  |
| (a)   |                 |               |         |                |      |               |      |                              | 35                           | 35             | 35        | 35              | 35              | 35        |                                           |       | 35                        |              |              |              |             |       |      |
| J     |                 |               |         |                |      |               |      |                              | 1.43                         | 1.47           | 1952      | 2.2             | 20.0            | 1937      |                                           |       | 2                         |              |              |              |             |       | J    |
| F     |                 |               |         |                |      |               |      |                              | 1.94                         | 1.61           | 1927      | 1.7             | 15.0            | 1928      |                                           |       | 4                         |              |              |              |             |       | F    |
| M     |                 |               |         |                |      |               |      |                              | 1.45                         | 2.46           | 1938      | 0.3             | 3.0             | 1946      |                                           |       | 3                         |              |              |              |             |       | M    |
| A     |                 |               |         |                |      |               |      |                              | 1.02                         | 1.23           | 1941      | 0.3             | 3.0             | 1927      |                                           |       | 2                         |              |              |              |             |       | A    |
| M     |                 |               |         |                |      |               |      |                              | 0.25                         | 1.24           | 1944      | 0.1             | 5.0             | 1930      |                                           |       | 1                         |              |              |              |             |       | M    |
| J     |                 |               |         |                |      |               |      |                              | 0.41                         | 2.24           | 1955      | 0.0             | 0.0             |           |                                           |       | 1                         |              |              |              |             |       | J    |
| J     |                 |               |         |                |      |               |      |                              | 2.09                         | 2.27           | 1934      | 0.0             | 0.0             |           |                                           |       | 4                         |              |              |              |             |       | J    |
| A     |                 |               |         |                |      |               |      |                              | 3.07                         | 3.47           | 1951      | T               | T               | 1955      |                                           |       | 6                         |              |              |              |             |       | A    |
| S     |                 |               |         |                |      |               |      |                              | 1.38                         | 1.81           | 1946      | 0.0             | 0.0             |           |                                           |       | 3                         |              |              |              |             |       | S    |
| O     |                 |               |         |                |      |               |      |                              | 1.07                         | 2.45           | 1921      | T               | 0.7             | 1949      |                                           |       | 2                         |              |              |              |             |       | O    |
| N     |                 |               |         |                |      |               |      |                              | 0.82                         | 1.67           | 1930      | T               | T               | 1953      |                                           |       | 2                         |              |              |              |             |       | N    |
| D     |                 |               |         |                |      |               |      |                              | 1.73                         | 2.20           | 1931      | 0.6             | 6.0             | 1931      |                                           |       | 3                         |              |              |              |             |       | D    |
| Year  |                 |               |         |                |      |               |      |                              | 16.66                        | 3.47           | Aug. 1951 | 5.2             | 20.0            | Jan. 1937 |                                           |       | 33                        |              |              |              |             |       | Year |

(a) Average length of record, years.

T Trace, an amount too small to measure.

\*\* Base 65 F.

† Also on earlier dates, months, or years.

\* Less than one half.

STATION HISTORY

| Observers            | Dates                 | Direction and Distance of Station from Post Office | Elevation (feet) | Station known as |
|----------------------|-----------------------|----------------------------------------------------|------------------|------------------|
| U. S. Forest Service | July 1919 - Jan. 1960 | 15 mi. ESE Mayer                                   | 4000             | Sycamore RS      |
| Charles B. Stewart   | Feb. 1960 -           | 2 mi. SE Dugan                                     | 4040             | Dugan 2 SE       |

The weather records summarized in this publication were made available through the cooperation and interest of the U. S. Forest Service.

## TOTAL PRECIPITATION (INCHES) FOR SYCAMORE RANGER STATION, ARIZONA

| Year | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| 1919 |      |      |      |      |      |      | 3.74 | 2.75 | 5.65 | 2.44 | 7.76 | 0.04 |        |
| 1920 | 1.88 | 4.93 | 1.25 | T    | 0.45 | 0.03 | 1.96 | 1.50 | 1.03 | 2.55 | 0.20 | 0.00 | 15.78  |
| 1921 | 0.55 | 0.50 | 2.00 | 1.00 | 0.02 | 0.00 | 6.06 | 2.59 | 0.00 | 3.30 | 0.04 | 1.95 | 18.01  |
| 1922 | 4.00 | 1.10 |      |      |      |      |      |      |      |      |      |      |        |
| 1923 |      |      |      |      |      |      |      | 3.55 | 1.72 | 0.01 |      |      |        |
| 1924 |      |      | 3.25 | 1.60 | 0.00 | 0.00 | 1.13 | 0.00 | 2.45 | 2.00 | 0.00 | 3.41 |        |
| 1925 | 1.00 |      | 0.60 | 1.92 | 0.00 | 0.31 | 1.40 | 4.71 | 4.61 | 2.42 | 0.09 | 0.03 |        |
| 1926 | 0.33 | 0.90 | 2.03 | 4.03 | 0.00 | 0.02 | 1.74 | 1.01 | 1.66 | 1.03 | 0.25 | 3.60 | 16.10  |
| 1927 | 0.24 | 5.95 | 2.12 | 1.00 | 0.17 | 0.65 | 3.17 | 3.48 | 4.32 | 1.83 | 0.60 | 2.67 | 25.00  |
| 1928 | 0.55 | 1.40 | 0.38 | 0.33 | 0.60 | T    | 0.55 | 0.98 | 0.74 | 0.00 | 0.40 | 1.02 | 6.75   |
| 1929 |      | 0.95 | 0.76 | 1.31 | T    | T    | 2.82 |      | 1.13 | 0.40 | T    | 0.00 |        |
| 1930 |      | 0.30 | 3.57 | 0.58 | 1.36 | 0.00 | 2.79 |      | 1.23 | T    | 2.26 |      |        |
| 1931 | T    | 7.51 | T    | 1.34 | 0.00 | 0.99 | 2.45 | 7.62 | 0.33 | 0.70 | 3.17 | 3.59 | 27.75  |
| 1932 | T    | 6.18 | 0.25 | 0.42 | 0.00 | 0.49 | 2.22 | 2.61 | 0.55 | 2.75 | 0.60 | 2.90 | 18.57  |
| 1933 | 2.77 | 0.25 | 0.00 |      | T    | 0.15 | 3.32 | 3.48 | 1.25 | 1.90 | 1.50 | 0.28 |        |
| 1934 | 0.38 | 0.98 | 0.30 | 0.93 |      | 0.25 | 2.52 | 2.44 | 1.20 | 0.00 | 1.25 | 2.13 |        |
| 1935 | 2.30 | 4.17 | 2.14 | 1.16 | 0.17 | T    | 0.67 | 3.71 | 2.11 | 0.07 | 1.13 | 0.59 | 18.22  |
| 1936 | 0.94 | 3.14 | 1.92 | 0.25 | 0.05 | 0.51 | 2.74 | 4.44 | 1.54 | 1.46 | 0.40 | 3.71 | 20.70  |
| 1937 | 2.65 | 1.06 | 2.60 | 0.14 | 0.10 | 0.45 | 1.94 | 1.84 | 0.95 | T    | 0.20 | 1.98 | 13.91  |
| 1938 | 0.68 | 3.01 | 2.90 | 0.13 | T    | 0.77 | 0.94 | 2.01 | 0.63 | T    | 0.60 | 4.90 | 15.97  |
| 1939 | 1.78 | 1.29 | 0.86 | 0.66 | T    | 0.07 | 0.73 | 3.67 | 3.10 | T    | 1.43 | 0.00 | 15.79  |
| 1940 | 0.70 | 2.31 | 0.37 | 1.48 | 0.30 | 1.60 | 0.12 | 5.28 | 3.07 | 3.16 | 1.54 | 5.16 | 25.45  |
| 1941 | 2.75 | 2.65 | 4.19 | 5.63 | 0.65 | 0.01 | 0.93 | 2.85 | 2.72 | 2.57 | 1.48 | 2.27 | 28.50  |
| 1942 | 0.58 | 2.02 | 0.50 | 1.67 | 0.00 | 0.00 | 0.97 | 2.31 | 0.28 | 0.92 | 0.19 | 0.76 | 10.40  |
| 1943 | 2.14 | 0.74 | 1.50 | 0.40 | 0.00 | T    | 1.12 | 2.48 | 1.60 | 0.45 | 0.03 | 3.24 | 13.90  |
| 1944 | 1.12 | 3.39 | 1.29 | 1.62 | 1.24 | T    | 0.36 | 2.10 | 0.90 | 0.32 | 3.09 | 1.93 | 19.38  |
| 1945 | 1.60 | 0.85 | 4.12 | 0.10 | 0.00 | 0.00 | 2.00 | 1.15 | 0.25 | 0.65 | 0.00 |      |        |
| 1946 |      | 0.68 | 0.35 | 1.26 | 0.15 | 0.00 | 1.77 | 3.63 | 2.36 | 1.10 | 1.74 | 1.72 |        |
| 1947 | 0.84 | 0.35 | 0.01 | T    | 0.54 | 0.00 | 0.98 | 5.30 | 1.64 | 0.63 | 1.72 | 2.03 | 12.94  |
| 1948 | 0.00 | 2.06 | 1.11 | T    | 0.00 | 0.27 | 0.47 | 1.34 | 1.10 | 1.18 | 0.00 |      |        |
| 1949 |      | 0.44 | 0.75 | 0.40 | 0.09 | 1.27 | 0.66 | 0.68 | 1.90 | 1.68 | 0.36 | 1.62 |        |
| 1950 | 0.56 | 1.33 | 1.19 | 0.00 | 0.23 | T    | 2.54 | 0.27 | 0.98 | 0.00 | 0.18 | T    | 7.28   |
| 1951 | 2.06 | 1.09 | 0.48 | 1.81 | 0.91 | T    | 1.21 | 8.85 | 0.90 | 1.48 | 1.12 | 2.06 | 21.97  |
| 1952 | 2.08 | 0.78 | 3.51 | 2.49 | T    | 0.22 | 2.68 | 5.05 | 2.19 | 0.60 | 3.51 | 1.10 | 23.41  |
| 1953 | 0.18 | 0.31 | 0.65 | 0.39 | 0.28 | T    | 3.92 | 1.49 | 0.13 | 0.05 | 0.20 | 0.51 | 8.31   |
| 1954 | 1.95 | 1.23 | 4.19 | 0.00 | 0.18 | 1.43 | 3.13 | 2.09 | 0.61 | 1.19 | 0.05 | 0.20 | 16.25  |
| 1955 | 3.21 | 0.63 | 0.12 | 0.45 | 0.09 | 2.24 | 5.44 | 7.86 | 0.00 | 0.40 | 0.63 | 1.02 | 22.09  |
| 1956 | 0.44 | 0.25 | 0.00 | 0.59 | T    | 1.45 | 3.02 | 0.75 | 0.11 | 1.14 | 0.00 | 0.30 | 8.05   |
| 1957 | 5.57 | 1.30 | 1.22 | 0.37 | 1.13 | 1.35 | 4.91 | 3.96 | 0.00 | 2.22 | 1.24 | 0.57 | 23.84  |
| 1958 | 0.10 | 2.68 | 2.78 | 1.37 | 0.50 | 0.66 | 0.70 | 1.62 | 4.78 | 1.10 | 0.93 | 0.00 | 17.22  |
| 1959 | 0.00 | 2.73 | 0.00 | 0.72 | 0.38 | 0.03 | 1.85 | 4.01 | 0.16 | 7.10 | 0.48 | 3.91 | 21.37  |
| 1960 |      |      | 0.50 |      |      |      |      |      |      |      |      |      |        |

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INSTITUTE OF ATMOSPHERIC PHYSICS, UNIVERSITY OF ARIZONA,  
AND THE U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU,  
CLIMATOGRAPHY OF THE UNITED STATES NO. 20-2

LATITUDE, 34° 41'  
LONGITUDE, 112° 10'  
ELEV. (GROUND), 6000 feet

CLIMATOLOGICAL SUMMARY

STATION, YAEGER CANYON

STATION NO. 02-9572-3

MEANS AND EXTREMES FOR PERIOD 1918 - 1948

| Month             | Temperature (°F) |                  |         |                   |      |                  |      | Estimated mean<br>degree days** | Precipitation Totals (inches) |              |              |                   |                    |              | Estimated mean<br>relative<br>humidity<br>(percent) |          | Mean number<br>of days         |                 |              |      |                 |                 | Month |                |      |
|-------------------|------------------|------------------|---------|-------------------|------|------------------|------|---------------------------------|-------------------------------|--------------|--------------|-------------------|--------------------|--------------|-----------------------------------------------------|----------|--------------------------------|-----------------|--------------|------|-----------------|-----------------|-------|----------------|------|
|                   | Means            |                  |         | Extremes          |      |                  |      |                                 | Mean                          | Greatest day | Year         | Snow, Sleet, Hail |                    |              |                                                     |          | Temperatures                   |                 |              |      |                 |                 |       |                |      |
|                   | Daily<br>maximum | Daily<br>minimum | Monthly | Record<br>highest | Year | Record<br>lowest | Year |                                 |                               |              |              | Mean              | Maximum<br>monthly | Year         | 6000 MST                                            | 1800 MST | precip. 10<br>miles or<br>more | 90 and<br>above | Temperatures |      | 32 and<br>below | 32 and<br>below |       | 0 and<br>below |      |
|                   |                  |                  |         |                   |      |                  |      |                                 |                               |              |              |                   |                    |              |                                                     |          |                                |                 | Max.         | Min. |                 |                 |       |                |      |
| (a)               |                  |                  |         |                   |      |                  |      |                                 | 29                            | 29           | 29           | 28                | 28                 | 28           |                                                     |          | 29                             |                 |              |      |                 |                 |       |                |      |
| J                 |                  |                  |         |                   |      |                  |      |                                 | 1.27                          | 1.40         | 1945         | 9.7               | 40.0               | 1933         |                                                     |          | 2                              |                 |              |      |                 |                 |       |                | J    |
| F                 |                  |                  |         |                   |      |                  |      |                                 | 1.69                          | 2.50         | 1927         | 7.6               | 38.0               | 1932         |                                                     |          | 3                              |                 |              |      |                 |                 |       |                | F    |
| M                 |                  |                  |         |                   |      |                  |      |                                 | 1.32                          | 1.99         | 1930         | 5.7               | 25.0               | 1924         |                                                     |          | 3                              |                 |              |      |                 |                 |       |                | M    |
| A                 |                  |                  |         |                   |      |                  |      |                                 | 1.14                          | 1.00         | 1946         | 2.2               | 15.0               | 1941         |                                                     |          | 2                              |                 |              |      |                 |                 |       |                | A    |
| M                 |                  |                  |         |                   |      |                  |      |                                 | 0.41                          | 0.68         | 1921         | 0.5               | 8.1                | 1921         |                                                     |          | 1                              |                 |              |      |                 |                 |       |                | M    |
| J                 |                  |                  |         |                   |      |                  |      |                                 | 0.49                          | 1.95         | 1940         | 0.0               | 0.0                |              |                                                     |          | 1                              |                 |              |      |                 |                 |       |                | J    |
| NO DATA AVAILABLE |                  |                  |         |                   |      |                  |      |                                 |                               |              |              |                   |                    |              |                                                     |          |                                |                 |              |      |                 |                 |       |                |      |
| J                 |                  |                  |         |                   |      |                  |      |                                 | 2.74                          | 2.30         | 1946         | 0.0               | 0.0                |              |                                                     |          | 6                              |                 |              |      |                 |                 |       |                | J    |
| A                 |                  |                  |         |                   |      |                  |      |                                 | 3.28                          | 2.00         | 1947         | 0.0               | 0.0                |              |                                                     |          | 6                              |                 |              |      |                 |                 |       |                | A    |
| S                 |                  |                  |         |                   |      |                  |      |                                 | 1.68                          | 1.42         | 1941         | 0.0               | 0.0                |              |                                                     |          | 2                              |                 |              |      |                 |                 |       |                | S    |
| O                 |                  |                  |         |                   |      |                  |      |                                 | 1.04                          | 1.77         | 1941         | 0.1               | 2.0                | 1920         |                                                     |          | 2                              |                 |              |      |                 |                 |       |                | O    |
| N                 |                  |                  |         |                   |      |                  |      |                                 | 0.99                          | 2.02         | 1923         | 2.8               | 16.0               | 1919         |                                                     |          | 1                              |                 |              |      |                 |                 |       |                | N    |
| D                 |                  |                  |         |                   |      |                  |      |                                 | 1.81                          | 1.97         | 1923         | 7.6               | 28.0               | 1936         |                                                     |          | 3                              |                 |              |      |                 |                 |       |                | D    |
| Year              |                  |                  |         |                   |      |                  |      |                                 | 17.86                         | 2.50         | Feb.<br>1927 | 36.2              | 40.0               | Jan.<br>1933 |                                                     |          | 32                             |                 |              |      |                 |                 |       |                | Year |

(a) Average length of record, years.

Y Trace, an amount too small to measure.

\*\* Base 65 F.

zr Also on earlier dates, months, or years.

\* Less than one half.

STATION HISTORY

| Observers            | Dates       | Direction and Distance of<br>Station from Post Office | Elevation<br>(feet) | Station known as |
|----------------------|-------------|-------------------------------------------------------|---------------------|------------------|
| U. S. Forest Service | Dec. 1917 - | 6 mi. SW Jerome                                       | 6000                | Yaeger Canyon    |

The weather records summarized in this publication were made available through the cooperation and interest of the U. S. Forest Service.

TOTAL PRECIPITATION (INCHES) FOR YAEGER CANYON, ARIZONA

| Year                                          | Jan. | Feb. | Mar. | Apr. | May  | June | July  | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|-----------------------------------------------|------|------|------|------|------|------|-------|------|------|------|------|------|--------|
| 1917                                          |      |      |      |      |      |      |       |      |      |      |      | 0.00 |        |
| 1918                                          | 2.00 | 1.13 | 3.03 | 0.00 | T    | 0.27 | 2.38  | 0.63 | 0.67 | 0.40 | 0.97 | 0.82 | 12.32  |
| 1919                                          | 0.50 | 3.00 | 0.70 | 1.90 | 0.79 | 0.80 | 11.22 | 1.09 | 2.71 | 1.60 | 2.86 | 0.22 | 28.19  |
| 1920                                          |      | 4.39 | 1.57 | 0.00 | 0.67 | 0.00 | 1.15  | 3.62 | 0.00 | 0.74 | 0.00 | 0.20 |        |
| 1921                                          |      | 0.40 | 0.93 | 0.28 | 1.38 | 0.21 | 4.40  |      |      |      |      | 2.26 |        |
| 1922                                          | 2.81 | 1.00 | 2.40 | 0.40 |      |      | 2.28  | 3.03 |      |      |      |      |        |
| 1923                                          | 1.20 | 0.58 | 0.40 |      |      | 0.00 | 2.50  | 3.62 | 2.15 | 0.10 | 2.02 | 3.65 |        |
| 1924                                          | 0.20 | 0.00 | 2.16 | 1.65 |      | 0.06 | 0.76  | T    |      |      | 0.50 | 2.70 |        |
| 1925                                          | 0.30 | 0.53 | 0.77 | 2.00 | 0.00 | 0.64 | 2.95  | 2.08 |      |      | 1.55 | 0.42 |        |
| 1926                                          | 0.55 | 1.20 | 2.20 | 6.27 | 0.49 | 0.13 | 1.79  | 0.90 | 2.93 | 0.35 | 0.45 | 4.52 | 22.38  |
| 1927                                          | 0.17 | 3.89 | 1.52 | 0.90 | 0.25 | 0.60 | 1.90  | 6.32 | 5.09 | 1.62 | 0.00 | 2.49 | 24.15  |
| 1928                                          | 0.43 | 3.04 | 0.17 | 0.51 | 0.73 | 0.07 | 0.58  | 2.50 | 0.57 | 1.28 | 1.16 | 2.22 | 13.08  |
| 1929                                          | 1.03 | 0.77 | 0.50 | 0.55 | 0.10 | T    | 5.16  | 4.19 | 0.67 | 0.17 | 0.10 | 0.00 | 13.24  |
| 1930                                          | 2.06 | 0.70 | 3.57 | 1.13 | 1.24 | 0.97 | 3.32  | 4.57 | 1.84 | 0.63 | 1.83 | 0.03 | 21.89  |
| 1931                                          | 0.59 | 4.27 | 0.36 | 1.32 | 0.05 | 0.96 | 3.31  | 6.57 | 1.08 | 0.93 | 3.04 | 0.99 | 23.47  |
| 1932                                          | 0.53 | 4.48 | 0.30 | 0.25 | 0.46 | 0.36 | 4.04  | 2.19 | 0.65 | 2.51 | 0.00 | 2.14 | 17.91  |
| 1933                                          | 4.23 | 0.30 | 0.04 | 0.03 | 0.33 | 2.23 | 4.11  | 4.33 | 2.31 | 2.41 | 2.26 | 0.20 | 23.63  |
| 1934                                          | 0.73 | 0.88 | 0.30 | 1.77 | 1.73 | 0.20 | 2.77  | 3.76 | 0.27 | T    | 0.92 | 2.38 | 15.71  |
| 1935                                          | 3.33 | 2.09 | 1.96 | 0.48 | 0.49 | T    | 1.42  | 5.18 | 2.08 | 0.19 | 1.23 | 0.96 | 19.41  |
| 1936                                          | 0.64 | 2.00 | 1.52 | 0.30 | 0.07 | 0.09 | 5.65  | 3.83 | 1.46 | 1.40 | 0.79 | 3.14 | 20.89  |
| 1937                                          | 2.12 | 2.07 | 2.23 | 0.03 | 0.51 | 0.70 | 2.33  | 2.38 | 1.46 | 0.00 | 0.00 | 1.77 | 15.60  |
| 1938                                          | 0.63 | 1.87 | 2.48 | 0.22 | 0.04 | 1.25 | 2.37  | 2.33 | 1.08 | T    | 0.04 | 3.02 | 15.35  |
| 1939                                          | 0.71 | 1.46 | 1.81 | 0.77 | T    | T    | 1.28  | 5.00 | 3.11 | 0.16 | 1.84 | 0.20 | 16.34  |
| 1940                                          | 1.55 | 1.83 | 0.02 | 1.31 | 0.38 | 4.26 | 0.12  | 2.34 | 4.02 | 3.40 |      | 4.42 |        |
| 1941                                          | 2.68 | 2.33 | 3.98 | 5.17 | 0.74 | 0.16 | 1.55  | 2.13 | 2.71 | 5.16 | 0.85 | 1.79 | 29.23  |
| 1942                                          | 1.02 | 1.07 | 0.23 | 1.47 | 0.00 | 0.00 | 2.06  | 2.76 | 0.45 | 0.54 | 0.21 | 1.13 | 10.94  |
| 1943                                          | 1.76 | 0.93 | 1.13 | 0.99 | T    | 0.04 | 0.54  | 5.96 | 2.10 | 0.90 | 0.00 | 3.06 | 17.43  |
| 1944                                          |      |      |      | 1.70 |      | 0.00 | 1.12  | 0.75 | 1.70 | 0.20 | 1.49 | 2.00 |        |
| 1945                                          | 1.80 | 1.27 | 1.40 | 0.00 | 0.00 | 0.00 | 1.55  | 4.00 | 0.06 | 0.80 | 0.00 | 1.35 | 12.23  |
| 1946                                          | 1.50 | 0.50 | 0.17 | 2.15 | 0.05 | 0.00 | 5.40  | 3.30 | 2.00 | 0.60 | 1.90 | 1.10 | 18.47  |
| 1947                                          | 0.30 | 0.20 | 0.00 | 0.00 | 0.50 |      | 1.60  | 6.35 | 0.40 | 1.00 | 0.60 | 2.80 |        |
| 1948                                          | 0.40 | 2.40 | 1.70 | 0.00 | 0.00 | 0.20 | 1.70  | 2.10 |      |      |      |      |        |
| no published data available after August 1948 |      |      |      |      |      |      |       |      |      |      |      |      |        |

This climatological summary has been made possible by a cooperative agreement between the University of Arizona and the United States Weather Bureau. Under the terms of this agreement the Institute of Atmospheric Physics of the University of Arizona has put on IBM punched cards all available daily weather data for the years prior to 1948 for over 100 observation stations in Arizona. In turn, the Weather Bureau has reproduced for the Institute, without charge, cards containing similar, but more recent, information which it has routinely punched since 1948. From these daily cards the Institute has produced, for all stations, summary cards which contain average weather data for each day, week, month, and each month of record. All of these decks of IBM punched cards are available for research work on request.

Copies of this climatological summary can be obtained from the Institute of Atmospheric Physics, University of Arizona, Tucson 25, Arizona.



## HYDROCLIMATOLOGY

### Section 1b - Snow Pack Characteristics

Five snow courses provide data which typifies snow pack conditions in the upper elevations of the Agua Fria Watershed. None of these courses are within the watershed, but all are adjacent to the watershed's boundary. Table 1 shows the snow course name and other locational information.

The highest elevation in the watershed is approximately 8,000 feet. The adjacent snow course at the highest elevation is Gaddes Canyon at 7,600 feet. Deep snowpacks with high water content are not characteristic of this watershed. Inspection of Exhibit 1 shows that the water content of the five courses plotted would correlate generally with elevation. Gaddes Canyon is disproportionately high in relation to elevation and the other courses. This is probably due to its orographic advantage of lying just over the crest of Mingus Mountain on the lee side of approaching storms and a more northerly protected aspect as compared to the other courses. Snow packs with water contents similar to that of Gaddes Canyon are of very limited extent in the Agua Fria Watershed. The Gaddes Canyon data is characteristic of limited areas such as the northeast slopes near the headwaters of Tuscumbia Creek, Poland Creek, Big Bug and Lynx Creeks. The Copper Basin, Iron Springs, Mingus Mountain and White Spar courses are highly representative of snow pack conditions in the remaining larger portion of this watershed's snowpack zone. Note in Tables 2-6 that with the exception of Gaddes Canyon, all snow courses show, at one time or another, no snow pack at all for each of the six dates of reading. The highest reading shown is a 46 inch depth with a 15.4 inch water content for Gaddes Canyon on February 15, 1968.

Table 7 summarizes the percent of readings which exceeded a snow depth of 6 inches. This depth has been selected as the minimum for which significant benefits might be derived from snow redistribution. Study of Table 7 indicates that suitable conditions would exist in less than one year out of four. Snow packs between 6" and 12" are considered marginal for such purposes and since they occur at infrequent intervals, the opportunities for substantial water yield increases through redistribution are very limited. Those headwaters areas mentioned above as having snowpacks similar to Gaddes Canyon would be the exception.

Table 8 includes storage gage data associated with the Copper Basin and Mingus Mountain snow courses.

No soil moisture measurements are made at any of the above discussed courses.

# INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

| Number | Name                       | Sec | Twp    | Rng   | Elevation | River Basin     |
|--------|----------------------------|-----|--------|-------|-----------|-----------------|
| 11R6   | Baker Butte (p)            | 4   | 12N    | 9E    | 7300      | Verde           |
| 9S1    | Baldy (p)                  | 28  | 7N     | 27E   | 9125      | Little Colorado |
| 9S15   | Baldy #2                   | 12  | 6N     | 26E   | 10000     | Little Colorado |
| 9S16   | Baldy #3                   | 13  | 6N     | 26E   | 11000     | Little Colorado |
| 10T1   | Bear Wallow                | 6   | 12S    | 16E   | 8100      | Gila            |
| 12P5   | Bill Williams Intermediate | 17  | 21N    | 2E    | 8550      | Lower Colorado  |
| 12P4   | Bill Williams Summit       | 17  | 21N    | 2E    | 8950      | Lower Colorado  |
| 9S6    | Blavor Hand                | 13  | 4N     | 30E   | 8000      | San Francisco   |
| 9S10-M | Black River Divide         | 10  | 6N     | 27E   | 9400      | Salt            |
| 12N1   | Bright Angel               | 34  | 23N    | 3E    | 8400      | Lower Colorado  |
| 12R1   | Camp Wood                  | 3   | 16N    | 6W    | 5700      | Verde           |
| 10R7-M | Canyon Creek #2            | 18  | 11N    | 15E   | 7500      | Little Colorado |
| 10R9   | Canyon Point (p)           | 28  | 11N    | 14E   | 7600      | Salt            |
| 11R2-M | Casner Park                | 19  | 18N    | 8E    | 6930      | Verde           |
| 12P1-M | Chalender                  | 27  | 22N    | 3E    | 7100      | Verde           |
| 12R6   | Copper Basin Divide (p)    | 23  | 13N    | 3W    | 6720      | Verde           |
| 10R8-M | Corduroy Creek             | 4   | 8N     | 21E   | 6600      | Salt            |
| 9S7    | Coronado Trail             | 26  | 5W     | 30E   | 8000      | San Francisco   |
| 9T2-A  | Crazy Horse                | 34  | 8S     | 24E   | 10200     | Gila            |
| 7T1    | Emory Pass #1              | 16  | 16S    | 9W**  | 7800      | Mimbres         |
| 7T2    | Emory Pass #2              | 16  | 16S    | 9W**  | 7800      | Mimbres         |
| 10R6   | Forest Dale                | 2   | 9N     | 21E   | 6430      | Salt            |
| 11P2   | Fort Valley (p)            | 22  | 22N    | 6E    | 7350      | Little Colorado |
| 9R5    | Ft. Apache                 | 18  | 7N     | 27E   | 9160      | Little Colorado |
| 8S1-M  | Frisco Divide              | 31  | 6S     | 20W** | 8000      | San Francisco   |
| 12R4   | Gadden Canyon              | 11  | 15N    | 2E    | 7600      | Verde           |
| 10R5   | Gentry                     | 36  | 11N    | 15E   | 7050      | Salt            |
| 11P1   | Grand Canyon               | 21  | 30N    | 4E    | 7500      | Lower Colorado  |
| 9S11   | Hannagan Meadows (p)       | 19  | 3N     | 29E   | 9990      | Salt            |
| 11R5   | Happy Jack                 | 30  | 17N    | 9E    | 7630      | Verde           |
| 9R10   | Hawley Lake                | 13  | 7N     | 24E   | 8300      | Salt            |
| 10R4   | Hober (p)                  | 28  | 11N    | 15E   | 7600      | Little Colorado |
| 9T1-A  | High Peak                  | 34  | 8S     | 24E   | 10500     | Gila            |
| 8S9-A  | Hummingbird                | 19  | 11S    | 17W** | 10550     | San Francisco   |
| 8S6    | Ice King                   | 6   | 11S    | 18W** | 8020      | San Francisco   |
| 7S2    | Inman                      | 6   | 11S    | 10W** | 7800      | Gila            |
| 12R2   | Iron Springs               | 22  | 14N    | 3W    | 6200      | Bill Williams   |
| 9S3    | Maverick Fork (p)          | 13  | 6N     | 27E   | 9150      | Salt            |
| 7S3-A  | McKnight Cabin             | 10  | 15S    | 10W** | 9300      | Mimbres         |
| 9R2-M  | McNary                     | 23  | 8N     | 23E   | 7200      | Salt            |
| 9R1    | Milk Ranch                 | 33  | 8N     | 23E   | 7000      | Salt            |
| 12R3   | Mingus Mountain            | 3   | 15N    | 2E    | 7100      | Verde           |
| 8S2    | Mogollon                   | 2   | 11S    | 19W** | 7000      | San Francisco   |
| 11R4   | Mormon Lake                | 13  | 18N    | 8E    | 7350      | Little Colorado |
| 11R3-M | Mormon Mountain (p)        | 14  | 18N    | 8E    | 7500      | Verde           |
| 9S12-A | Mt. Ord                    | 4   | 6N     | 26E   | 11000     | Salt            |
| 11R1-M | Munds Park                 | 15  | 18N    | 7E    | 6500      | Verde           |
| 11P5-M | Newman Park                | 25  | 19N    | 6E    | 6750      | Verde           |
| 9S4    | Nutriso                    | 23  | 6N     | 30E   | 8500      | San Francisco   |
| 9S5    | Pacheta                    | 27  | 4-1/2N | 27E   | 7800      | Salt            |
| 8S7    | Redstone Trail             | 5   | 11S    | 18W** | 8600      | San Francisco   |
| 10T2   | Rose Canyon                | 15  | 12S    | 16E   | 7300      | Gila            |
| 8S8    | Silver Creek Divide        | 4   | 11S    | 18W** | 9000      | San Francisco   |
| 9S14-A | Smith Cienega              | 10  | 6N     | 26E   | 9850      | Salt            |
| 11P4   | Snow Bowl #1 (p)           | 36  | 23N    | 6E    | 10260     | Verde           |
| 11P6   | Snow Bowl #2               | 31  | 23N    | 7E    | 11000     | Verde           |
| 9S3    | State Line                 | 6   | 6S     | 21W** | 8000      | San Francisco   |
| 12R5   | White Bear                 | 19  | 13N    | 2W    | 6000      | Verde           |
| 12P2   | White Horse Lake Jet       | 2   | 20N    | 2E    | 7150      | Verde           |
| 8S10-A | Whitewater                 | 19  | 11S    | 17W** | 10750     | Gila            |
| 12P3   | Williams Ski Run           | 9   | 21N    | 2E    | 7720      | Lower Colorado  |
| 13P1   | Willow Ranch               | 16  | 21N    | 11W   | 5000      | Bill Williams   |
| 9R6    | Wilson Lake (p)            | 4   | 7N     | 26E   | 9000      | Salt            |
| 10S1   | Workman Creek              | 33  | 6N     | 14E   | 6900      | Salt            |

M SOIL MOISTURE STA.

(p) STORAGE GAGE

A AERIAL SNOW DEPTH MARKER

W SOIL MOISTURE STA. ONLY

MM PRINCIPAL MERIDIAN

SNOW COURSES (UNDERLINED) PROVIDING DATA

APPLICABLE TO AGUA FRIA WATERSHED



Water Content In Snow Pack - Inches

6

5

4

3

2

1

# SNOW PACK WATER CONTENT

Snow Courses Adjacent To  
The  
Agua Fria Watershed

From: "Water Supply Outlook For Arizona"  
1942-62 average

Iron Springs  
Mojave Mtn.

Copper Basin

Gardner Canyon

White Deer

Jan 15 Feb. 1 Feb. 15 Mar. 1 Mar. 15 Apr. 1  
Approximate Date of Snow Course Readings

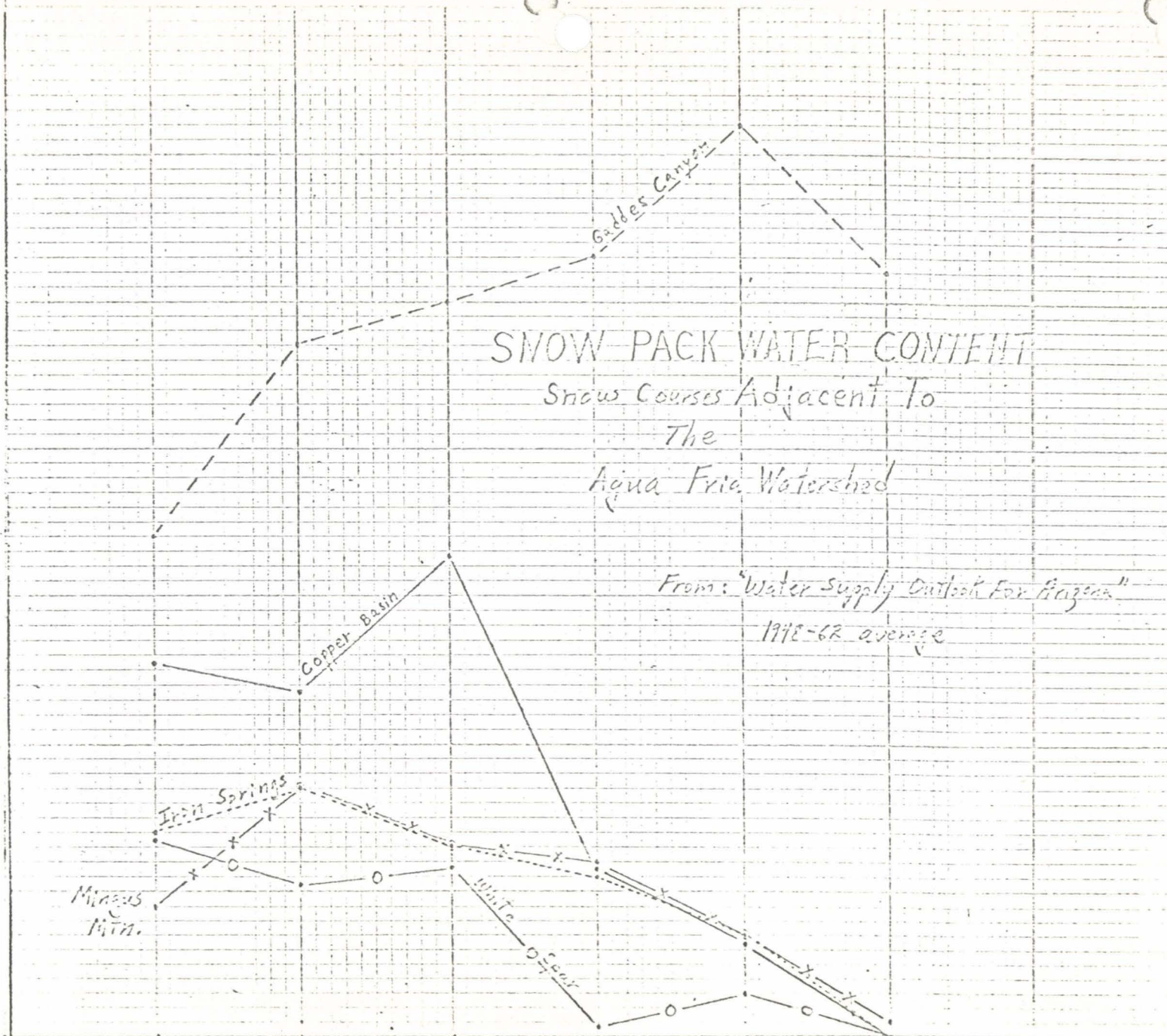


Table 7 Frequency of Snow Pack Conditions Suitable for Snow Redistribution  
by Clearcut Patterns of Timber Harvesting

| Snow<br>Course  | January 15                                                    |    | February 1 |    | February 15 |    | March 1 |    | March 15 |    | April 1 |   |
|-----------------|---------------------------------------------------------------|----|------------|----|-------------|----|---------|----|----------|----|---------|---|
|                 | Number of times that snow pack has exceeded 6 inches of depth |    |            |    |             |    |         |    |          |    |         |   |
|                 | No.                                                           | %  | No.        | %  | No.         | %  | No.     | %  | No.      | %  | No.     | % |
| Iron<br>Springs | <u>1</u><br>6                                                 | 26 | 7          | 30 | 5           | 22 | 5       | 22 | 4        | 17 | 0       | - |
| Mingus<br>Mtn.  | <u>2</u><br>5                                                 | 23 | 7          | 32 | 8           | 36 | 6       | 27 | 4        | 18 | 1       | 4 |

1 Records begin 1946 - 1968 23 years

2 Records begin 1947 - 1968 22 years



Table 8 Storage Gage Data Adjacent To The Agua Fria Watershed <sup>/1</sup>

| Year | Date of Reading | Total catch<br>Nov.1 to date<br>of reading | Average Total<br>catch No.1 to<br>date of reading |
|------|-----------------|--------------------------------------------|---------------------------------------------------|
|------|-----------------|--------------------------------------------|---------------------------------------------------|

Copper Basin Divide

|      |      |       |    |
|------|------|-------|----|
| 1965 | 3-31 | 11.65 | -- |
| 1966 | 3-31 | 20.34 | -- |
| 1967 | 3-31 | 8.89  | -- |

MINGUS MOUNTAIN

|      |      |       |                     |
|------|------|-------|---------------------|
| 1965 | 3-31 | 12.54 | 10.11 <sup>/2</sup> |
| 1966 | 3-31 | 16.88 | 10.11               |
| 1967 | 3-31 | 4.94  | 10.11               |

<sup>/1</sup> From April 1 reports of "Water Supply Outlook for Arizona" S.C.S.

<sup>/2</sup> 1948-1962 average

# ARIZONA SNOW COURSE DATA SUMMARY

Snow Course : WHITE SPAR

Elevation : 6000'

Basin : COLORADO

Arizona Number : 12R5

Location : Sec 19; Twp 13N; Rge 2W

Stream : VERDE RIVER

| YEAR | JANUARY 15 |                           |                  | FEBRUARY 1 |                           |                  | FEBRUARY 15 |                           |                  | MARCH 1 |                           |                  | MARCH 15 |                           |                  | APRIL 1 |                           |                  |
|------|------------|---------------------------|------------------|------------|---------------------------|------------------|-------------|---------------------------|------------------|---------|---------------------------|------------------|----------|---------------------------|------------------|---------|---------------------------|------------------|
|      | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE        | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT |
| 1963 | 1/14       | 0                         | 0.0              | 1/31       | 0                         | 0.0              | 2/14        | 4                         | 1.1              | 2/28    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/29    | 0                         | 0.0              |
| 1964 | 1/14       | 0                         | 0.0              | 1/31       | 0                         | 0.0              | 2/14        | 0                         | 0.0              | 2/28    | 0                         | 0.0              | 3/13     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1965 | 1/14       | 0                         | 0.0              | 1/29       | 0                         | 0.0              | 2/12        | 8                         | 1.5              | 2/26    | 0                         | 0.0              | 3/12     | 8                         | 1.5              | 3/31    | 0                         | 0.0              |
| 1966 | 1/14       | 0                         | 0.0              | 1/31       | 1                         | 0.2              | 2/14        | 8                         | 1.4              | 2/28    | 1                         | 0.4              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1967 | 1/13       | 1                         | 0.3              | 1/31       | T                         | 0.1              | 2/14        | 0                         | 0.0              | 2/27    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1968 | 1/12       | 21                        | 8.0              | 1/30       | 13                        | 5.9              | 2/14        | 10                        | 3.0              | 2/29    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
|      | Total      |                           | 8.0              |            |                           | 6.2              |             |                           | 7.0              |         |                           | 0.4              |          |                           | 1.5              |         |                           | 0.0              |
|      | Average    | (1.33)                    |                  |            |                           | (1.032)          |             |                           | (1.167)          |         |                           | (.0666)          |          |                           | (0.30)           |         |                           | (0.0)            |



## ARIZONA SNOW COURSE DATA SUMMARY

new Course : MINGUS MOUNTAIN

*Elevation:* 7100'

*Basin :* COLORADO

Accession Number: 1283

*Location:* Sec 3; Twp 15N; Rge 2E

Stream: VERDE RIVER

| YEAR | JANUARY 15 |                           |                              | FEBRUARY 1 |                           |                              | FEBRUARY 15 |                           |                              | MARCH 1 |                           |                              | MARCH 15 |                           |                              | APRIL 1  |                           |                              |
|------|------------|---------------------------|------------------------------|------------|---------------------------|------------------------------|-------------|---------------------------|------------------------------|---------|---------------------------|------------------------------|----------|---------------------------|------------------------------|----------|---------------------------|------------------------------|
|      | DATE       | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT | DATE       | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT | DATE        | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | (inches)<br>WATER<br>CONTENT |
| 1947 | 1/15       | 2                         | 0.1                          | 2/3        | 0                         | 0.0                          | 2/14        | 0                         | 0.0                          | 2/28    | 0                         | 0.0                          | 3/16     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1948 | 1/15       | 0                         | 0.0                          | 2/1        | 0                         | 0.0                          | 2/15        | 5                         | 0.5                          | 2/29    | 8                         | 1.5                          | 3/15     | 6                         | 2.3                          | 4/1      | 0                         | 0.0                          |
| 1949 | 1/15       | 19                        | 4.3                          | 2/1        | 36                        | 10.4                         | 2/14        | 30                        | 10.8                         | 3/2     | 17                        | 7.8                          | ---      | ---                       | ---                          | 3/31     | T                         | T                            |
| 1950 | 1/16       | T                         | T                            | 1/31       | 8                         | 1.0                          | 2/16        | T                         | T                            | 2/28    | T                         | T                            | 3/15     | T                         | T                            | ---      | ---                       | ---                          |
| 1951 | 1/15       | T                         | T                            | 2/2        | 4                         | 0.1                          | 2/14        | 0                         | 0.0                          | 3/1     | 4                         | 1.3                          | 3/15     | 0                         | 0.0                          | 4/1      | 0                         | 0.0                          |
| 1952 | 1/15       | 5                         | 1.4                          | 2/2        | 1                         | 0.1                          | 2/14        | 2                         | 0.6                          | 3/1     | 3                         | 0.9                          | 3/16     | 13                        | 3.3                          | 4/1      | T                         | T                            |
| 1953 | 1/15       | 0                         | 0.0                          | 1/31       | 0                         | 0.0                          | 2/19        | 0                         | 0.0                          | 3/2     | 7                         | 1.0                          | 3/16     | T                         | T                            | 3/28     | 0                         | 0.0                          |
| 1954 | 1/14       | 6                         | 0.6                          | 2/1        | 5                         | 1.2                          | 2/15        | 9                         | 1.2                          | 3/4     | 0                         | 0.0                          | 3/15     | 0                         | 0.0                          | 4/1      | 0                         | 0.0                          |
| 1955 | 1/14       | 13                        | 2.8                          | 1/31       | 10                        | 2.7                          | 2/14        | 6                         | 1.8                          | 3/2     | T                         | T                            | 3/15     | 0                         | 0.0                          | ---      | ---                       | ---                          |
| 1956 | 1/16       | 0                         | 0.0                          | 1/30       | T                         | T                            | 2/13        | T                         | T                            | 2/29    | 0                         | 0.0                          | 3/14     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1957 | 1/14       | 0                         | 0.0                          | 1/31       | 17                        | 2.9                          | 2/15        | T                         | T                            | 2/29    | 0                         | 0.0                          | 3/15     | 0                         | 0.0                          | 4/1      | 0                         | 0.0                          |
| 1958 | 1/14       | 0                         | 0.0                          | 1/31       | 0                         | 0.0                          | 2/14        | 0                         | 0.0                          | 2/28    | T                         | T                            | 3/14     | 8                         | 1.9                          | 3/31     | 0                         | 0.0                          |
| 1959 | 1/14       | 0                         | 0.0                          | 1/30       | 0                         | 0.0                          | 2/13        | 10                        | 2.5                          | 2/27    | 5                         | 1.7                          | 3/13     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1960 | 1/14       | 16                        | 2.9                          | 1/29       | 7                         | 2.5                          | 2/12        | 5                         | 1.5                          | 2/29    | 12                        | 2.5                          | 3/14     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1961 | 1/13       | 0                         | 0.0                          | 1/31       | 3                         | 0.8                          | 2/14        | 0                         | 0.0                          | 2/28    | 0                         | 0.0                          | 3/14     | 0                         | 0.0                          | 3/31     | 6                         | 1.1                          |
| 1962 | 1/15       | 5                         | 1.5                          | 1/31       | 10                        | 3.4                          | 2/14        | 0                         | 0.0                          | 2/28    | 11                        | 1.9                          | 3/14     | 5                         | 1.4                          | 3/30     | 0                         | 0.0                          |
| 1963 | 1/14       | 4                         | 1.2                          | 1/31       | 0                         | 0.0                          | 2/14        | 6                         | 1.4                          | 2/28    | 0                         | 0.0                          | 3/14     | 0                         | 0.0                          | 3/29     | 0                         | 0.0                          |
| 1964 | 1/14       | 0                         | 0.0                          | 1/31       | 0                         | 0.0                          | 2/14        | 0                         | 0.0                          | 2/28    | 0                         | 0.0                          | 3/13     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1965 | 1/14       | 0                         | 0.0                          | 1/29       | T                         | T                            | 2/12        | 12                        | 2.3                          | 2/26    | T                         | T                            | 3/12     | 7                         | 0.9                          | 3/31     | 0                         | 0.0                          |
| 1966 | 1/14       | T                         | T                            | 1/31       | 5                         | 1.0                          | 2/14        | 11                        | 2.8                          | 3/1     | 7                         | 2.4                          | 3/14     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1967 | 1/13       | 0                         | 0.0                          | 1/30       | 0                         | 0.0                          | 2/14        | 0                         | 0.0                          | 2/28    | 0                         | 0.0                          | 3/14     | 0                         | 0.0                          | 3/31     | 0                         | 0.0                          |
| 1968 | 1/15       | 24                        | 8.6 (0.9)                    | 1/31       | 21                        | 7.4 (1.7)                    | 2/14        | 20                        | 6.4 (1.3)                    | 2/29    | 2                         | 0.6 (1.2)                    |          |                           |                              |          |                           |                              |
| 1962 |            |                           |                              |            |                           |                              |             |                           |                              |         |                           |                              |          |                           |                              | APRIL 15 |                           |                              |
|      |            |                           |                              |            |                           |                              |             |                           |                              |         |                           |                              |          |                           |                              | 4/13     | 0                         | 0.0                          |

( ) 1948-1962 15 year average



# ARIZONA SNOW COURSE DATA SUMMARY

Snow Course : IRON SPRINGS

Elevation : 6200'

Basin : COLORADO

Arizona Number : 12R2

Location : Sec 22; Twp 14N; Rge 3W

Stream : BILL WILLIAMS RIVER

| YEAR                          | JANUARY 15 |                           |                  | FEBRUARY 1 |                           |                  | FEBRUARY 15 |                           |                  | MARCH 1 |                           |                  | MARCH 15 |                           |                  | APRIL 1 |                           |                  |
|-------------------------------|------------|---------------------------|------------------|------------|---------------------------|------------------|-------------|---------------------------|------------------|---------|---------------------------|------------------|----------|---------------------------|------------------|---------|---------------------------|------------------|
|                               | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE        | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT |
| 1946                          | 1/15       | 5                         | 1.3              | 1/29       | 0                         | 0.0              | 2/12        | T                         | T                | 2/25    | 0                         | 0.0              | 3/12     | 0                         | 0.0              | 4/2     | T                         | T                |
| 1947                          | 1/14       | 0                         | 0.0              | 1/29       | T                         | T                | 2/15        | 0                         | 0.0              | 2/26    | 0                         | 0.0              | 3/12     | 0                         | 0.0              | 4/2     | 0                         | 0.0              |
| 1948                          | 1/15       | 0                         | 0.0              | 1/29       | 0                         | 0.0              | 2/12        | 5                         | 0.5              | 2/26    | 4                         | 1.0              | 3/12     | 0                         | 0.0              | 4/1     | 0                         | 0.0              |
| 1949                          | 1/15       | 17                        | 5.2              | 1/29       | 33                        | 9.6              | 2/12        | 34                        | 10.9             | 2/26    | 21                        | 7.8              | 3/12     | 6                         | 3.4              | 3/26    | 0                         | 0.0              |
| 1950                          | 1/16       | T                         | T                | 1/30       | 0                         | 0.0              | 2/13        | T                         | T                | 2/27    | 0                         | 0.0              | 3/13     | 0                         | 0.0              | 3/27    | 0                         | 0.0              |
| 1951                          | 1/15       | T                         | T                | 1/29       | 0                         | 0.0              | 2/19        | 6                         | 2.0              | 3/5     | 10                        | 2.6              | 3/12     | 0                         | 0.0              | 4/2     | 0                         | 0.0              |
| 1952                          | 1/15       | 5                         | 2.5              | 1/29       | 0                         | 0.0              | 2/12        | T                         | T                | 3/4     | 6                         | 2.4              | 3/11     | 21                        | 5.2              | 4/1     | 0                         | 0.0              |
| 1953                          | 1/15       | 0                         | 0.0              | 1/29       | 0                         | 0.0              | 2/12        | 0                         | 0.0              | 3/5     | 5                         | 0.7              | 3/12     | 0                         | 0.0              | 4/2     | 0                         | 0.0              |
| 1954                          | 1/15       | 7                         | 0.9              | 1/29       | 7                         | 0.8              | 2/12        | 0                         | 0.0              | 3/5     | 0                         | 0.0              | 3/12     | 0                         | 0.0              | 4/2     | 0                         | 0.0              |
| 1955                          | 1/17       | 16                        | 5.9              | 1/31       | 12                        | 4.5              | 2/14        | 3                         | 0.8              | 2/26    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | ---     | ---                       | ---              |
| 1956                          | 1/15       | 0                         | 0.0              | 1/30       | 0                         | 0.0              | 2/14        | 2                         | 0.1              | 2/29    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/30    | 0                         | 0.0              |
| 1957                          | 1/14       | 0                         | 0.0              | 1/28       | 17                        | 5.1              | 2/11        | 3                         | 1.9              | 3/4     | 0                         | 0.0              | 3/18     | 0                         | 0.0              | 4/1     | T                         | T                |
| 1958                          | 1/14       | 0                         | 0.0              | 1/28       | T                         | T                | 2/11        | 0                         | 0.0              | 3/4     | T                         | T                | 3/18     | 0                         | 0.0              | 4/1     | 0                         | 0.0              |
| 1959                          | 1/14       | 0                         | 0.0              | 1/28       | 0                         | 0.0              | 2/11        | 14                        | 2.5              | 2/25    | 7                         | 2.0              | 3/11     | 0                         | 0.0              | 4/1     | 0                         | 0.0              |
| 1960                          | 1/14       | 12                        | 5.0              | 1/28       | 8                         | 2.5              | 2/11        | 3                         | 0.9              | 3/3     | 0                         | 0.0              | 3/10     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1961                          | 1/14       | 0                         | 0.0              | 1/28       | 0                         | 0.0              | 2/11        | 0                         | 0.0              | 2/25    | 0                         | 0.0              | 3/11     | 0                         | 0.0              | 4/1     | ---                       | ---              |
| 1962                          | 1/15       | 6                         | 1.0              | 1/29       | 10                        | 2.4              | 2/12        | 0                         | 0.0              | 2/26    | 7                         | 1.7              | 3/12     | 6                         | 1.6              | 3/26    | 0                         | 0.0              |
| 1963                          | 1/14       | T                         | T                | 1/31       | 0                         | 0.0              | 2/14        | T                         | T                | 2/28    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/30    | 0                         | 0.0              |
| 1964                          | 1/14       | 0                         | 0.0              | 1/31       | 0                         | 0.0              | 2/14        | 0                         | 0.0              | 2/29    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1965                          | 1/14       | 0                         | 0.0              | 1/29       | 0                         | 0.0              | 2/12        | 5                         | 1.1              | 2/26    | 0                         | 0.0              | 3/12     | 6                         | 1.1              | 3/31    | 0                         | 0.0              |
| 1966                          | 1/14       | 0                         | 0.0              | 1/31       | 3                         | 0.7              | 2/14        | 7                         | 1.3              | 2/28    | 2                         | 0.7              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1967                          | 1/13       | 1                         | 0.2              | 1/31       | 1                         | 0.1              | 2/14        | 0                         | 0.0              | 2/28    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/31    | 0                         | 0.0              |
| 1968                          | 1/15       | 19                        | 6.7 (1.4)        | 2/1        | 14                        | 6.0 (1.7)        | 2/14        | 8                         | 3.0 (1.3)        | 2/29    | 0                         | 0.0 (1.1)        | 3/14     | 0                         | 0.0 (0.7)        | 3/31    | 0                         | 0.0 (0.0)        |
| ( ) 1948-1962 15 year average |            |                           |                  |            |                           |                  |             |                           |                  |         |                           |                  |          |                           |                  |         |                           |                  |



# ARIZONA SNOW COLLECTOR DATA SUMMARY

Snow Course : GADDES CANYON

Elevation : 7600'

Basin : COLORADO

Arizona Number : 12R4

Location : Sec 11; Twp 15N; Rge 2E

Stream : VERDE RIVER

| YEAR                          | JANUARY 15 |                           |                  | FEBRUARY 1 |                           |                  | FEBRUARY 15 |                           |                  | MARCH 1 |                           |                  | MARCH 15 |                           |                  | APRIL 1  |                           |                  |
|-------------------------------|------------|---------------------------|------------------|------------|---------------------------|------------------|-------------|---------------------------|------------------|---------|---------------------------|------------------|----------|---------------------------|------------------|----------|---------------------------|------------------|
|                               | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE       | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE        | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE    | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT | DATE     | (inches)<br>SNOW<br>DEPTH | WATER<br>CONTENT |
| 1954                          | 1/14       | 10                        | 1.2              | 2/1        | 13                        | 3.6              | 2/15        | 22                        | 2.6              | 3/4     | T                         | T                | 3/15     | 6                         | 2.3              | 4/1      | 11                        | 4.1              |
| 1955                          | 1/14       | 20                        | 3.9              | 1/31       | 19                        | 2.9              | 2/14        | 17                        | 4.4              | 3/2     | 17                        | 5.2              | 3/15     | 9                         | 3.1              | ---      | ---                       | ---              |
| 1956                          | 1/16       | T                         | T                | 1/30       | 8                         | 2.6              | 2/13        | 9                         | 3.3              | 2/29    | 9                         | 3.1              | 3/14     | 2                         | 0.8              | 3/31     | T                         | T                |
| 1957                          | 1/14       | 0                         | 0.0              | 1/31       | 23                        | 4.3              | 2/15        | 10                        | 3.5              | 2/28    | 6                         | 2.6              | 3/15     | 2                         | 0.8              | 4/1      | 0                         | 0.0              |
| 1958                          | 1/14       | 0                         | 0.0              | 1/31       | 2                         | 0.3              | 2/14        | 10                        | 2.3              | 2/28    | 5                         | 1.9              | 3/14     | 19                        | 4.8              | 3/31     | 10                        | 4.4              |
| 1959                          | 1/14       | 3                         | 1.0              | 1/30       | 2                         | 0.6              | 2/13        | 16                        | 4.1              | 2/27    | 15                        | 5.2              | 3/13     | 10                        | 4.1              | 3/31     | T                         | T                |
| 1960                          | 1/14       | 31                        | 6.6              | 1/29       | 24                        | 7.4              | 2/12        | 28                        | 7.4              | 2/29    | 37                        | 9.4              | 3/14     | 28                        | 8.7              | 3/31     | 6                         | 2.6              |
| 1961                          | 1/13       | 4                         | 0.6              | 1/31       | 8                         | 2.2              | 2/14        | 6                         | 1.7              | 2/28    | 3                         | 0.8              | 3/14     | 3                         | 0.9              | 3/31     | 12                        | 2.4              |
| 1962                          | 1/15       | 19                        | 4.5              | 1/31       | 29                        | 7.8              | 2/14        | 23                        | 7.6              | 2/28    | 33                        | 10.6             | 3/14     | 35                        | 11.2             | 3/30     | 30                        | 9.9              |
| 1963                          | 1/14       | 7                         | 1.7              | 1/31       | 5                         | 1.7              | 2/14        | 13                        | 2.7              | 2/28    | 9                         | 2.3              | 3/14     | 7                         | 1.9              | 3/29     | 3                         | 0.9              |
| 1964                          | 1/14       | 2                         | 0.3              | 1/31       | 3                         | 0.7              | 2/14        | 2                         | 0.4              | 2/28    | 4                         | 0.6              | 3/13     | 6                         | 1.4              | 3/31     | 4                         | 1.2              |
| 1965                          | 1/14       | 10                        | 3.6              | 1/29       | 13                        | 4.4              | 2/12        | 30                        | 7.0              | 2/26    | 22                        | 6.7              | 3/12     | 30                        | 7.2              | 3/31     | 24                        | 7.5              |
| 1966                          | 1/14       | 18                        | 4.8              | 1/31       | 23                        | 6.2              | 2/14        | 33                        | 8.0              | 3/1     | 31                        | 8.2              | 3/14     | 26                        | 7.6              | 3/31     | 10                        | 3.2              |
| 1967                          | 1/13       | 3                         | 0.7              | 1/30       | 5                         | 1.1              | 2/14        | 2                         | 0.3              | 2/28    | 0                         | 0.0              | 3/14     | 0                         | 0.0              | 3/31     | 10.2                      | (5.2)            |
| 1968                          | 1/15       | 41                        | 14.1 (3.4)       | 1/31       | 41                        | 14.5 (4.7)       | 2/14        | 46                        | 15.4 (5.0)       | 2/29    | 31                        | 12.7 (5.3)       |          |                           |                  |          |                           |                  |
| ( ) 1948-1962 15 year average |            |                           |                  |            |                           |                  |             |                           |                  |         |                           |                  |          |                           |                  |          |                           |                  |
| 1962                          |            |                           |                  |            |                           |                  |             |                           |                  |         |                           |                  |          |                           |                  | APRIL 15 |                           |                  |
|                               |            |                           |                  |            |                           |                  |             |                           |                  |         |                           |                  |          |                           |                  | 4/13     | 5                         | 2.1              |



# ARIZONA SNOW COURSE DATA SUMMARY

CORTEX MOUNT DITCH

Elevation: 6720'

Basin: GILKRAPO

1286

Location: Sec 23; Twp 13N; Rge 3E

Stream: VALLE RIVER

| JANUARY 15 |            |               | FEBRUARY 1 |            |               | FEBRUARY 15 |            |               | MARCH 1 |            |               | MARCH 15 |            |               | APRIL 1 |            |               |
|------------|------------|---------------|------------|------------|---------------|-------------|------------|---------------|---------|------------|---------------|----------|------------|---------------|---------|------------|---------------|
| DATE       | SNOW DEPTH | WATER CONTENT | DATE       | SNOW DEPTH | WATER CONTENT | DATE        | SNOW DEPTH | WATER CONTENT | DATE    | SNOW DEPTH | WATER CONTENT | DATE     | SNOW DEPTH | WATER CONTENT | DATE    | SNOW DEPTH | WATER CONTENT |
| 1/14       | 5          | 8.6           | 1/31       | 0          | 0.0           | 2/14        | 12         | 2.8           | 2/28    | 0          | 0.0           | 3/14     | 0          | 0.0           | 3/29    | 0          | 0.0           |
| 1/14       | 6          | 8.0           | 1/31       | 0          | 0.0           | 2/14        | 0          | 0.0           | 2/28    | 0          | 0.0           | 3/13     | 1          | 0.2           | 3/31    | 0          | 0.0           |
| 2/14       | 0          | 0.0           | 2/22       | T          | T             | 2/12        | 13         | 2.3           | 2/25    | 2          | 0.7           | 3/12     | 12         | 1.9           | 3/31    | 0          | 0.0           |
| 2/14       | 8          | 2.7           | 2/31       | 21         | 3.1           | 2/14        | 20         | 5.4           | 2/23    | 13         | 1.1           | 3/14     | 3          | 1.1           | 3/31    | 0          | 0.0           |
| 2/13       | 3          | 0.8           | 2/31       | 1          | 0.3           | 2/14        | 0          | 0.0           | 2/28    | 0          | 0.0           | 3/14     | 0          | 0.0           | 3/31    | 0          | 0.0           |
| 2/15       | 39         | 10.0          | 2/31       | 27         | 10.8          | 2/14        | 26         | 9.2           | 2/29    | 5          | 2.0           |          |            |               |         |            |               |
| Total      |            |               |            |            |               |             |            |               |         |            |               |          |            |               |         |            |               |
| 15         | 15.2       |               | 39         | 14.2       |               | 71          | 19.7       |               | 20      | 7.0        |               | 16       | 3.2        |               | 0       | 0.0        |               |
| 7.65       | (2.53)     |               | 6.50       | (2.37)     |               | 11.82       | (3.20)     |               | 3.34    | (1.167)    |               | 3.2      | (0.6)      |               | 0       | (0.0)      |               |



Section 2a. Runoff and Water Yield

# ANNUAL RUNOFF & PRECIPITATION

## AGUA FRIA WATERSHED

above and including Big Bay Creek

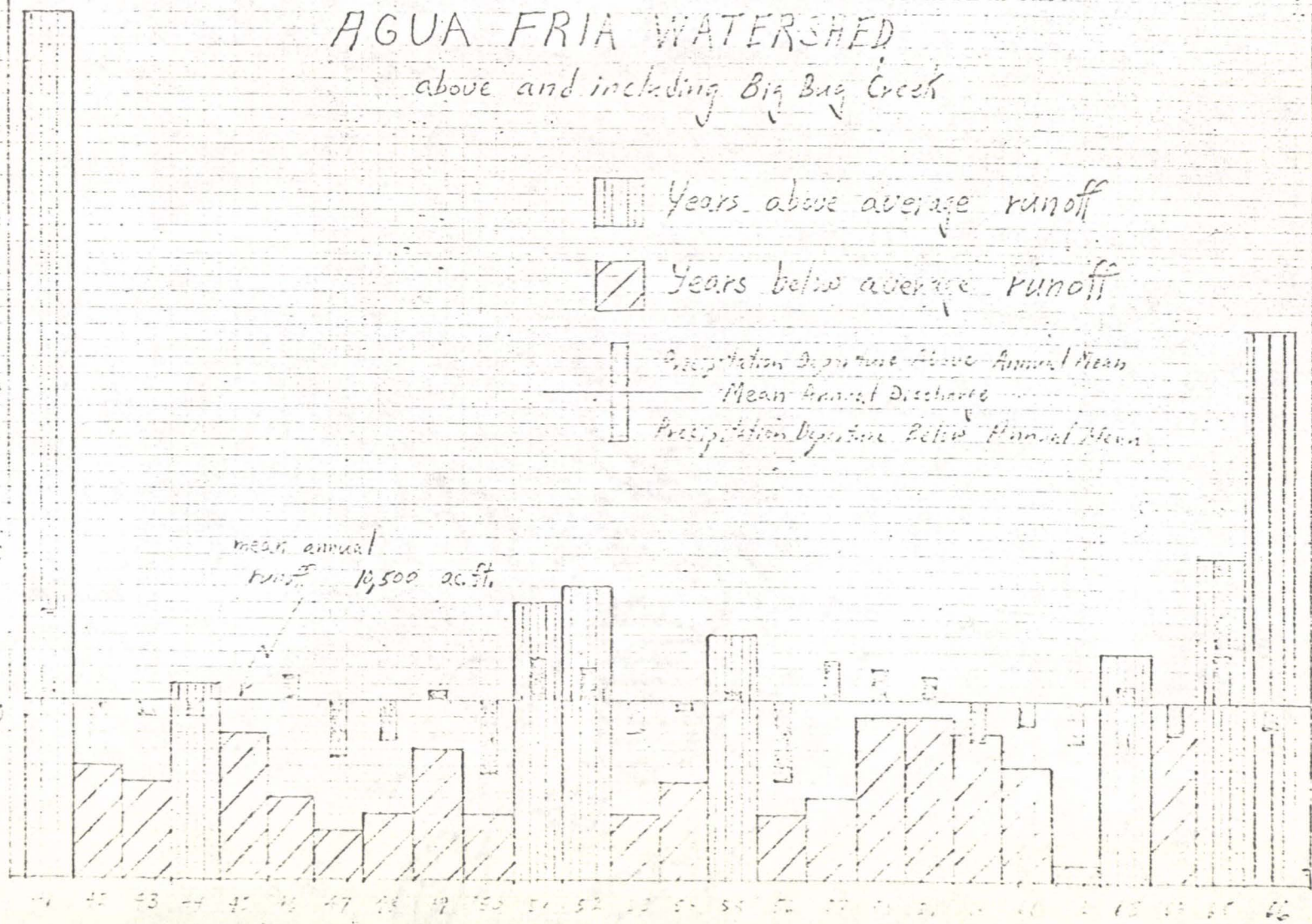
ANNUAL RUNOFF — Thous. of Acre Feet

- Years above average runoff
- Years below average runoff
- Precipitation Departure Above Annual Mean
- Mean Annual Discharge
- Precipitation Departure Below Annual Mean

mean annual  
runoff 10,500 ac.ft.

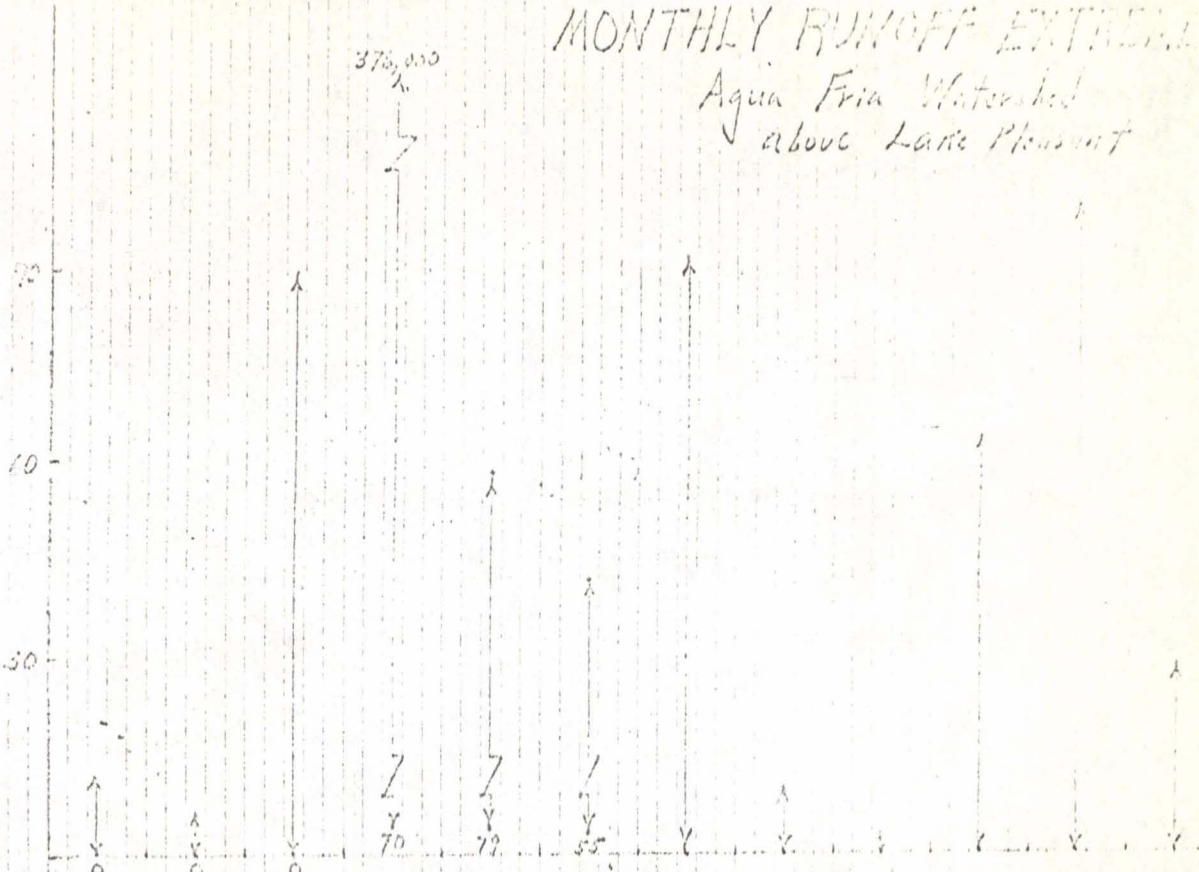
ANNUAL PRECIPITATION DEPARTURES — percent of annual mean

(Summation of Prescott, Crown King and Dugway Stations)





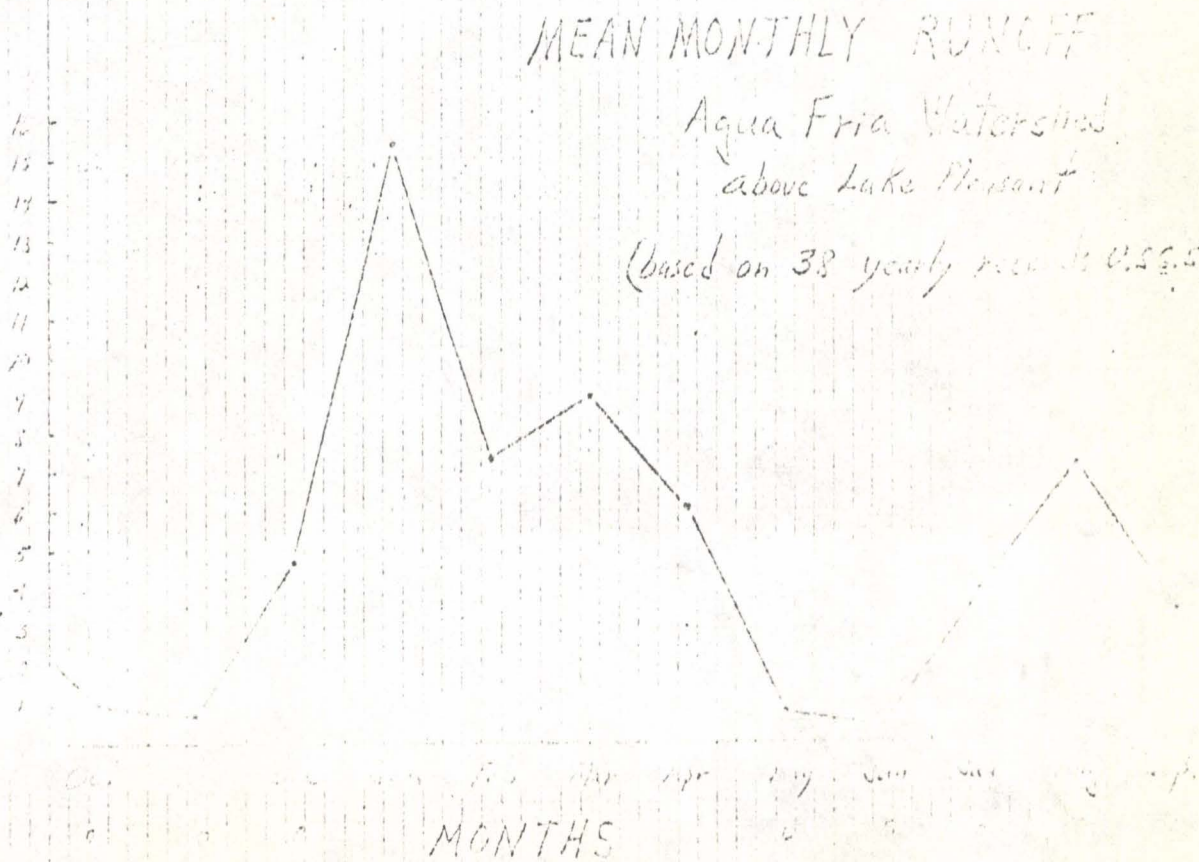
MONTHLY RUNOFF EXTREMES -  $\frac{\text{in.}}{\text{sq. mi.}}$



# MONTHLY RUNOFF EXTREMES

Agua Fria Watershed  
above Lake Pleasant

MONTHLY RUNOFF -  $\frac{\text{in.}}{\text{sq. mi.}}$

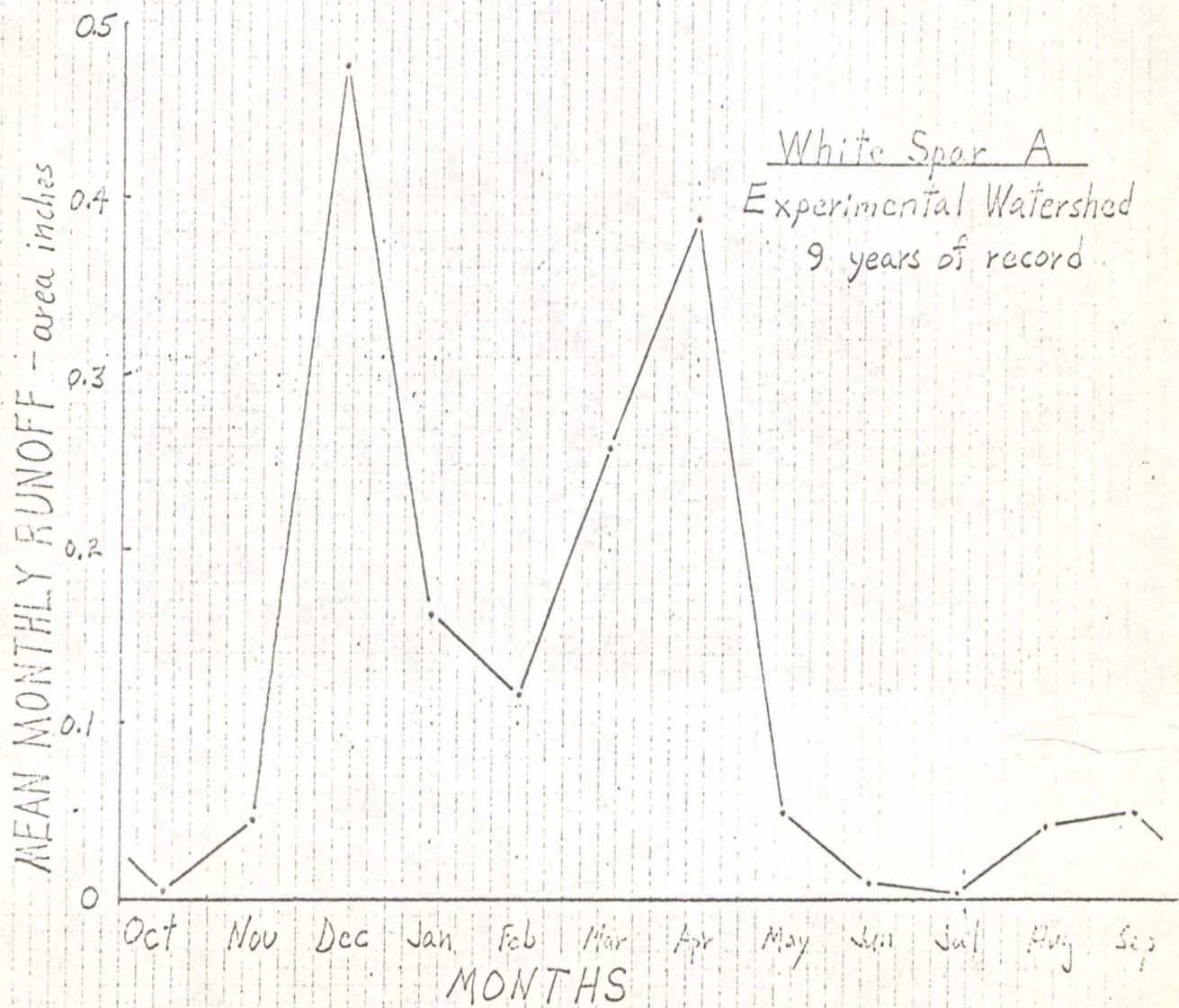
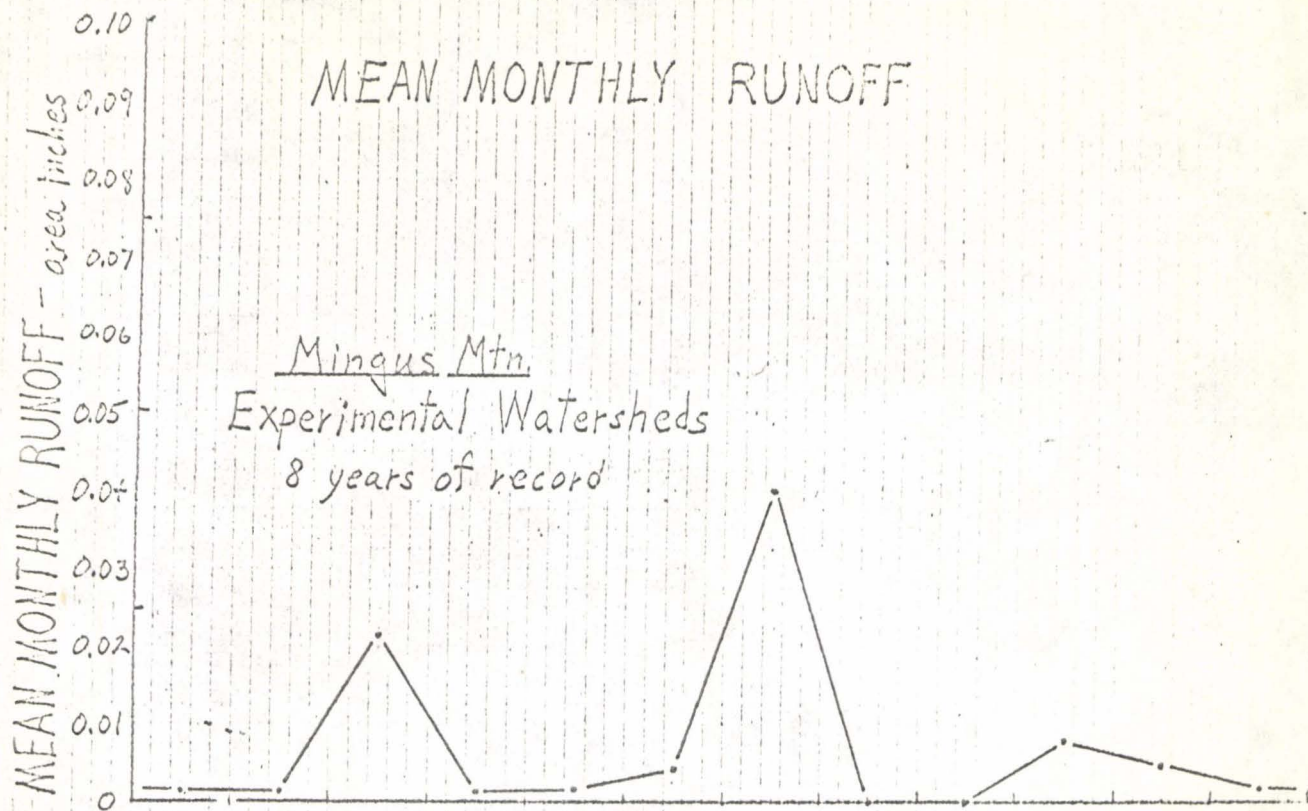


## MEAN MONTHLY RUNOFF

Agua Fria Watershed  
above Lake Pleasant

(based on 38 yearly mean U.S.G.S.)

MONTHS





RUNOFF White Spar A - area inches (Hassayampa Drainage)

Indicates that runoff in the Agua Fria is exponentially increased in the headwater areas as winter runoff increases in percent of total annual runoff due to increasing area of zero soil moisture deficits

assumes theoretical possibility of headwater flows without runoff on mountains

fit by eye to years influenced by winter precipitation

## ANNUAL RUNOFF

Headwaters Vs. Upper 1/2 Watershed

65 - water year 1965

⊗ - Over 86% of annual flow near Meyer from May 1 thru November 30

X - Over 53% of annual flow near Meyer from Dec. 1 thru Apr. 30

Indicates no change in relative contribution as summer runoff increases in percent of total annual runoff - no zero soil moisture deficits

0

5

15

25

35

RUNOFF



SUMMARY OF WATER YIELDS FROM  
NATIONAL FOREST WATERSHEDS IN ARIZONA <sup>/1</sup>

| Watershed                    | No.<br>of<br>Years | Elevation<br>Range<br>(ft.) | Acres     | Annual<br>Precip.<br>(in.) | Annual<br>Runoff<br>Area Inches |       |       |
|------------------------------|--------------------|-----------------------------|-----------|----------------------------|---------------------------------|-------|-------|
|                              |                    |                             |           |                            | L <sup>2</sup>                  | M     | H     |
| <u>Ponderosa Pine</u>        |                    |                             |           |                            |                                 |       |       |
| <u>Workman Creek</u>         |                    |                             |           |                            |                                 |       |       |
| Middle Fork <u>/3</u>        | 20                 | 6590-7720                   | 521       | 32                         | 0.9                             | 2.8   | 13.2  |
| North Fork                   | 20                 | 6590-7720                   | 248       | 32                         | 1.3                             | 3.1   | 11.2  |
| <u>Castle Creek</u>          |                    |                             |           |                            |                                 |       |       |
| West Fork                    | 9                  | 7840-8600                   | 900       | 27                         | -                               | 2.2   | -     |
| East Fork                    | 9                  | 7840-8400                   | 1168      | 27                         | -                               | 3.0   | 2     |
| <u>Beaver Creek</u>          | 9                  | 6400-7700                   | 2036(max) | 25                         | 0.3                             | 4.8   | 10.4  |
| 8 watersheds                 |                    |                             |           |                            |                                 |       |       |
| <u>Chaparral</u>             |                    |                             |           |                            |                                 |       |       |
| <u>Parker Creek</u>          | 22                 | 5150-7583                   | 700       | 25                         | 2.0                             | 5.4   | 21.6  |
| <u>Three-Bar</u>             |                    |                             |           |                            |                                 |       |       |
| Watersheds C&D               | 3                  | 3200-5200                   | 95(max)   | 21                         | 0.01                            | 0.76  | 1.41  |
| <u>White Spar</u> <u>/4</u>  |                    |                             |           |                            |                                 |       |       |
| Watershed A                  | 9                  | 6000-7400                   | -         | 24*                        | 0.01*                           | 1.61* | 6.52* |
| Watershed B                  | 9                  | 5800-6700                   | -         | 24*                        | 0.01*                           | 1.19* | 4.96* |
| <u>Mingus Mtn.</u> <u>/4</u> |                    |                             |           |                            |                                 |       |       |
| Watershed A                  | 8                  | ( 6000-                     | -         | 19*                        | T                               | 0.03* | 0.16* |
| Watershed B                  | 8                  | ( 6800 approx.              | -         | 19*                        | T                               | 0.09* | 0.42* |
| Watershed C                  | 8                  | ( Westerly                  | -         | 22*                        | T                               | 0.13* | 0.41* |
|                              |                    | ( Aspect                    | -         |                            |                                 |       |       |
| <u>Pinyon-Juniper</u>        |                    |                             |           |                            |                                 |       |       |
| <u>Beaver Creek</u>          |                    |                             |           |                            |                                 |       |       |
| Alligator Watersheds (3)     |                    |                             |           |                            |                                 |       |       |
| 9                            |                    | 6300-6500                   | 346(max)  | 20                         | 0.13                            | 3.9   | 11.3  |
| Utah Watersheds (3)          |                    |                             |           |                            |                                 |       |       |
| 9                            |                    | 5000-5500                   | 362(max)  | 19                         | 0.00                            | 1.1   | 3.80* |

/1 From J. F. Arnold 1/4/67 unpublished summary sheets

/2 L = low M=Mean H=High

/3 Prior to vegetation conversion

/4 From RME&RS, Tempe, Ariz. (Tel. 5-2-68)

\* These figures subject to revision - not for publication



Table Yearly Runoff From Chaparral Watersheds on the Prescott Natl. Forest <sup>/1</sup>

| Water<br>Year | WHITE SPAR |        |        |        | MINGUS MOUNTAIN |        |        |        |        |        |
|---------------|------------|--------|--------|--------|-----------------|--------|--------|--------|--------|--------|
|               | A          |        | B      |        | A               |        | B      |        | C      |        |
|               | Runoff     | Precip | Runoff | Precip | Runoff          | Precip | Runoff | Precip | Runoff | Precip |
|               | inches     |        |        |        |                 |        |        |        |        |        |
| 1959          | 0.22       | 20     | 0.22   | 21     | 0.004           | 16     | 0.003  | 16     | 0.06   | 19     |
| 1960          | 0.91       | 21     | 0.70   | 21     | 0.01            | 17     | 0.02   | 17     | 0.07   | 19     |
| 1961          | 0.01       | 19     | 0.01   | 19     | 0.001           | 18     | 0.12   | 18     | 0.16   | 22     |
| 1962          | 0.12       | 21     | 0.26   | 21     | 0.001           | 14     | 0.01   | 14     | 0.02   | 17     |
| 1963          | 0.55       | 25     | 0.19   | 23     | 0.001           | 15     | 0.01   | 15     | 0.004  | 16     |
| 1964          | 0.36       | 20     | 0.21   | 20     | 0.001           | 14     | 0.003  | 14     | 0.004  | 16     |
| 1965          | 4.54       | 34     | 3.26   | 34     | 0.16            | 21     | 0.12   | 21     | 0.11   | 24     |
| 1966          | 6.52       | 29     | 4.96   | 29     | 0.06            | 19     | 0.16   | 19     | 0.31   | 22     |
| 1967          | 0.94       | 25     | 0.92   | 24     | -               | 15     | -      | 15     | -      | 18     |
| Average       | 1.61       | 24     | 1.19   | 24     | 0.030           | 19     | 0.093  | 19     | 0.130  | 22     |

<sup>/1</sup> From BTF&RS, Tempe, Arizona (Tel. 5-2-68) subject to revision - not for publication

MEAN ANNUAL WATER YIELD - AGUA FRIA WATERSHED

PRESCOTT NATIONAL FOREST

(as Computed by the Penmon Method)

| Precipitation<br>Zone<br>(inches) | Present Mean<br>Computed Annual Yield<br>(AC-Ft) | Yield as Percent<br>of East or West<br>Agua Fria |
|-----------------------------------|--------------------------------------------------|--------------------------------------------------|
| <u>East Side Agua Fria</u>        |                                                  |                                                  |
| 14                                | 1,905                                            | 5                                                |
| 18                                | 19,149                                           | 52                                               |
| 22.5                              | 11,586                                           | 32                                               |
| 25+                               | <u>3,912</u>                                     | <u>11</u>                                        |
| Total                             | 36,553                                           | 100                                              |
| <u>West Side Agua Fria</u>        |                                                  |                                                  |
| 14                                | 441                                              | 3                                                |
| 18                                | 11,320                                           | 64                                               |
| 22.5                              | 4,154                                            | 24                                               |
| 25+                               | <u>1,648</u>                                     | <u>9</u>                                         |
| Total                             | 17,563                                           | 100                                              |

Total Prescott National Forest 54,116



Computation of Average Annual Runoff in Area Inches

Agua Fria River Near Mayer, Arizona

Average Discharge, 26 years 11,370 ac-ft per yr.

Drainage area 588 Sq. Mi.

$$12 \text{ in/ft} \times 11,370 \text{ ac.ft.} \div 588 \text{ Mi.}^2 \times 640 \text{ ac/mi}^2 = 0.363 \text{ inches}$$

Agua Fria River at Waddell Dam, Arizona

Average discharge, 38 years 61,470 ac-ft per yr.

Drainage area 1,459 sq. mi.

$$12 \text{ in/ft} \times 61,470 \text{ ac-ft} \div 1,459 \text{ sq.mi.} \times 640 \text{ ac/mi}^2 \times 12 \text{ in/ft} = 0.790 \text{ inches}$$

/1 Source: Water Resources Data For Arizona - 1966. United States Department of The Interior, Geological Survey

1459 Sq. miles above Waddell Dam (933,760 acres)

650 Sq. miles of Natl. Forest land (415,907 acres)

809 Sq. miles of other land (517,760 acres)

$$415,907 \div 933,760 = 45\% \text{ N.F.}$$

TABLE DIVERSTIONS TO THE PERRY CANAL  
FROM THE AGUA FRIA RIVER NEAR MAYER, ARIZONA

1950 - 1960

| Water<br>Year | Yearly<br>Combined<br>Flow | Yearly<br>River Flow<br>below Diversion | Diversions<br>To The<br>Perry Canal |
|---------------|----------------------------|-----------------------------------------|-------------------------------------|
|               | acre-feet                  |                                         |                                     |
| 1951          | 17,430                     | 16,850                                  | 580                                 |
| 1952          | 18,130                     | 17,880                                  | 250                                 |
| 1953          | 4,220                      | 3,730                                   | 490                                 |
| 1954          | 6,230                      | 6,110                                   | 120                                 |
| 1955          | 14,960                     | 14,730                                  | 230                                 |
| 1956          | 3,570                      | 3,130                                   | 440                                 |
| 1957          | 4,520                      | 4,400                                   | 120                                 |
| 1958          | 10,100                     | 10,050                                  | 50                                  |
| 1959          | 10,370                     | 10,250                                  | 120                                 |
| 1960          | 9,380                      | 9,380                                   | 0                                   |
|               |                            | Total                                   | 2400                                |
|               |                            | Average                                 | 240                                 |



## 700. Agua Fria River near Mayer, Ariz.

Location.--Lat 34°19', long. 112°04', in NW1/4 sec. 20, T. 11 N., R. 3 E., at Sycamore dam site, 700 ft downstream from Bigbug Creek, and 12 miles southeast of Mayer.  
 Drainage area.--508 sq mi.  
 Gage.--Water-stage recorder. Altitude of gage is 3,434 ft (levels by Maricopa County Municipal Water Conservation District No. 1).  
 Average discharge.--10 years (1940-49), 15.1 cfs (not including Perry Canal).  
 Extreme.--1940-49: Maximum discharge, 15,000 cfs Mar. 1, 1941 (stage height, 11.97 ft); from rating curve extended above 1,000 cfs on basis of slope-area determination of peak flow; negligible flow at times during winter months in most years when entire flow was diverted above station by Perry Canal and flow past gage was seepage only.  
 Remarks.--Diversions above station for mining and for irrigation of about 600 acres, a small part of which is below station. For total flow of river at Sycamore dam site see last table herewith showing combined flow of Agua Fria River and of Perry Canal, which diverts just above station.

Monthly and yearly mean discharge, in second-foot

| Water year | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sept. | The year |
|------------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
| 1940       | -    | -    | -    | 2.9  | 13.3 | 2.01 | 0.50 | 7.20 | 29.7 | 0.96 | 27.5 | 32.8  | -        |
| 1941       | 14.0 | 1.70 | 107  | 43.7 | 76.4 | 253  | 314  | 19.6 | 4.8  | 13.9 | 16.2 | 14.8  | 73.2     |
| 1942       | 16.7 | 9.6  | 16.0 | 14.1 | 9.2  | 10.8 | 3.6  | 2.2  | .77  | 6.15 | 25.3 | .90   | 9.70     |
| 1943       | 1.45 | 1.6  | 2.5  | 4.0  | 4.1  | 7.3  | 2.1  | .72  | .25  | 2.13 | 28.0 | 39.9  | 7.84     |
| 1944       | 2.4  | 2.1  | 5.0  | 4.5  | 58.2 | 74.9 | 5.6  | 3.4  | .59  | .60  | 6.79 | 25.6  | 15.7     |
| 1945       | 1.07 | 1.90 | 3.09 | 6.7  | 12.8 | 66.6 | 5.2  | 1.27 | .69  | 13.1 | 27.2 | .2    | 11.0     |
| 1946       | 4.71 | 1.26 | 2.44 | 4.1  | 3.4  | 1.82 | .98  | .10  | .20  | 16.6 | 40.7 | 3.10  | 6.71     |
| 1947       | .52  | 2.70 | 5.11 | 4.37 | 2.64 | 2.03 | 1.05 | .33  | .22  | .26  | 27.2 | 2.96  | 4.27     |
| 1948       | .62  | .60  | 3.69 | 1.27 | 2.45 | 2.45 | 1.21 | .55  | .31  | .37  | 40.6 | .51   | 4.95     |
| 1949       | .07  | .67  | 1.04 | 59.6 | 43.4 | 12.1 | .56  | .29  | 1.35 | 4.62 | 2.70 | 7.97  | 11.2     |
| 1950       | 15.4 | .10  | .10  | .10  | 1.74 | 2.03 | .92  | .50  | .10  | 29.0 | 7.06 | 1.94  | 5.06     |

Monthly and yearly runoff, in acre-foot

| Water year | Oct.  | Nov. | Dec.  | Jan.  | Feb.  | Mar.   | Apr.   | May | June  | July  | Aug.  | Sept. | The year |
|------------|-------|------|-------|-------|-------|--------|--------|-----|-------|-------|-------|-------|----------|
| 1940       | -     | -    | -     | 177   | 766   | 123    | 35     | 443 | 1,770 | 59    | 1,690 | 1,950 | -        |
| 1941       | 921   | 101  | 4,610 | 2,690 | 4,240 | 15,530 | 10,700 | 210 | 206   | 855   | 996   | 803   | 53,020   |
| 1942       | 1,030 | 573  | 1,040 | 869   | 514   | 662    | 212    | 133 | 46    | 397   | 1,560 | 56    | 7,450    |
| 1943       | 89    | 95   | 165   | 246   | 230   | 440    | 125    | 44  | 15    | 131   | 1,720 | 2,370 | 5,670    |
| 1944       | 147   | 123  | 309   | 276   | 3,350 | 4,610  | 335    | 204 | 35    | 37    | 414   | 1,540 | 11,340   |
| 1945       | 66    | 110  | 739   | 433   | 710   | 4,100  | 307    | 70  | 41    | 804   | 1,670 | 17    | 8,550    |
| 1946       | 200   | 75   | 140   | 244   | 190   | 117    | 47     | 6.1 | 12    | 1,020 | 2,500 | 180   | 4,800    |
| 1947       | 37    | 161  | 318   | 269   | 167   | 134    | 110    | 20  | 13    | 54    | 1,670 | 176   | 3,090    |
| 1948       | 40    | 40   | 227   | 78    | 164   | 151    | 71     | 10  | 10    | 24    | 2,750 | 30    | 6,670    |
| 1949       | 44    | 40   | 131   | 1,670 | 2,410 | 747    | 33     | 34  | 80    | 246   | 171   | 479   | 8,090    |
| 1950       | 949   | 6.0  | 6.1   | 6.1   | 96    | 174    | 55     | 11  | 6.0   | 1,760 | 434   | 116   | 3,440    |

Yearly discharge, in second-foot

| Year | W.S.P. no. | Water year ending Sept. 30 |                |             |      | Calendar year       |      |                     |  |
|------|------------|----------------------------|----------------|-------------|------|---------------------|------|---------------------|--|
|      |            | Momentary maximum          |                | Minimum day | Mean | Runoff in acre-foot | Mean | Runoff in acre-foot |  |
|      |            | Discharge                  | Date           |             |      |                     |      |                     |  |
| 1940 | 899        | 45,920                     | June 26, 1940  | -           | -    | -                   | 20.2 | 14,640              |  |
| 1941 | 929        | 13,000                     | Mar. 1, 1941   | 0.4         | 73.2 | 53,020              | 66.3 | 48,030              |  |
| 1942 | 959        | 6,280                      | Aug. 6, 1942   | .2          | 9.78 | 7,090               | 6.62 | 4,750               |  |
| 1943 | 979        | 3,500                      | Sept. 25, 1943 | .1          | 7.84 | 5,670               | 6.17 | 5,920               |  |
| 1944 | 1009       | 3,810                      | Sept. 16, 1944 | .2          | 15.7 | 11,360              | 15.4 | 11,220              |  |
| 1945 | 1039       | 2,620                      | July 27, 1945  | .1          | 11.6 | 8,560               | 11.9 | 8,650               |  |
| 1946 | 1059       | 4,930                      | July 22, 1946  | .1          | 6.71 | 4,850               | 6.70 | 4,840               |  |
| 1947 | 1069       | 1,610                      | Aug. 16, 1947  | .1          | 4.27 | 3,070               | 3.99 | 2,890               |  |
| 1948 | 1119       | 5,630                      | Aug. 4, 1948   | -           | 4.98 | 3,620               | 4.66 | 3,520               |  |
| 1949 | 1149       | 2,460                      | Jan. 13, 1949  | .1          | 11.2 | 8,090               | 12.2 | 8,650               |  |
| 1950 | 1179       | 2,170                      | July 17, 1950  | .1          | 5.66 | 3,660               | -    | -                   |  |

a-Maximum for water year.

Combined runoff, in acre-foot, of Agua Fria River and Perry Canal near Mayer, Ariz.

| Water year | Oct.  | Nov. | Dec.  | Jan.  | Feb.  | Mar.   | Apr.   | May   | June  | July  | Aug.  | Sept. | The year |
|------------|-------|------|-------|-------|-------|--------|--------|-------|-------|-------|-------|-------|----------|
| 1940       | -     | -    | -     | 230   | 766   | 140    | 117    | 466   | 1,770 | 60    | 1,740 | 1,950 | -        |
| 1941       | 944   | 131  | 6,620 | 2,690 | 4,240 | 15,530 | 10,760 | 1,210 | 324   | 893   | 1,030 | 806   | 53,206   |
| 1942       | 1,030 | 573  | 1,040 | 869   | 514   | 679    | 212    | 133   | 46    | 397   | 1,570 | 56    | 7,450    |
| 1943       | 117   | 119  | 180   | 244   | 230   | 450    | 126    | 44    | 15    | 166   | 1,740 | 2,410 | 6,660    |
| 1944       | 147   | 123  | 309   | 276   | 3,350 | 4,610  | 335    | 251   | 35    | 37    | 414   | 1,540 | 11,340   |
| 1945       | 77    | 134  | 249   | 430   | 745   | 4,100  | 355    | 139   | 95    | 806   | 1,660 | 66    | 8,890    |
| 1946       | 324   | 91   | 145   | 254   | 190   | 209    | 101    | 46    | 63    | 1,050 | 2,500 | 227   | 5,350    |
| 1947       | 77    | 179  | 316   | 269   | 166   | 162    | 133    | 20    | 13    | 54    | 1,670 | 189   | 3,430    |
| 1948       | 49    | 40   | 227   | 78    | 174   | 161    | 72     | 10    | 10    | 24    | 2,750 | 30    | 3,790    |
| 1949       | 72    | 40   | 117   | 1,670 | 2,410 | 829    | 217    | 107   | 102   | 296   | 171   | 474   | 8,000    |
| 1950       | 957   | 73   | 144   | 164   | 245   | 267    | 102    | 85    | 49    | 1,830 | 434   | 116   | 4,410    |



## 790. Agua Fria River at Lake Pleasant Dam, Ariz. 1/

Location.--Lat 33°51', long. 112°16', in NW Sec. 21, T. 6 N., R. 1 E., immediately upstream from Lake Pleasant Dam, 22 miles northwest of Glendale and 24 miles upstream from mouth of New River.

Drainage area.--1,400 sq mi., approximately.

Available records.--November 1910 to September 1911 and October 1912 to September 1923, gage heights and discharge measurements; October 1923 to September 1924, gage heights only.

Gage.--Staff gage since Oct. 1, 1933. Datum of gage is 1,431.2 ft above mean sea level, datum of 1929. Prior to Sept. 30, 1933, staff gage (and also water-stage recorder Aug. 29, 1913, to Jan. 27, 1916, and Mar. 31, 1916, to Nov. 27, 1919) at several sites at or near diversion dam 1.5 miles downstream at different datums.

Average discharge.--23 years (1914-19, 1933-50), 169 cfs (revised).

Extremes.--1910-24, 1933-50: Maximum discharge, about 105,000 cfs Nov. 27, 1919 (gage height, 33 ft, datum then in use, from floodmarks); from rating curve extended above 13,000 cfs on basis of velocity-area studies; no flow during spring and summer of several years.

A discharge of about 105,000 cfs (gage height, 30 ft, same datum as in 1919, from floodmarks), occurred Jan. 28, 1916 (date corrected). On basis of comparative gage heights, flood of Nov. 27, 1919, is believed to have been the greater.

Remarks.--Diversion above Lake Pleasant for irrigation of not over 1,000 acres. Discharge since Oct. 1, 1933, computed on basis of three factors as follows: 1. Change in contents of Lake Pleasant and of small reservoir behind diversion dam 1.5 miles downstream from Lake Pleasant. 2. (a) Release from Lake Pleasant as measured by water-stage recorder and sharp-crested rectangular weir in canal 650 ft downstream from intake at diversion dam, rated by current-meter measurements and frequently checked by Clauson-Pierce weir rule; and (b) spill from Lake Pleasant as measured over diversion dam (none since May 13, 1941). 3. Effect of precipitation and evaporation on lake; evaporation assumed as 0.7, prior to 1949, of that measured once daily in 3 ft-square buried lamp pan near Lake Pleasant and as 0.65, since 1949. Effect of bank storage and bank release in Lake Pleasant is not taken into account.

Cooperation.--Records since Oct. 1, 1933, collected and prepared in cooperation with Maricopa County Municipal Water Conservation District No. 1.

Monthly and yearly mean discharge, in second-feet

| Water year | Oct. | Nov. | Dec. | Jan. | Feb.  | Mar.  | Apr.  | May  | June | July | Aug. | Sept. | The year |
|------------|------|------|------|------|-------|-------|-------|------|------|------|------|-------|----------|
| 1915       | 43.0 | 7.3  | 164  | 149  | 870   | 148   | 41.3  | 161  | 9.9  | 88.5 | 59.4 | 40.3  | *233     |
| 1916       | 2.9  | 39.2 | 244  | 635  | 577   | 505   | 149   | 27.3 | 7.0  | 24.6 | 62.1 | 120   | *663     |
| 1917       | 202  | 16.7 | 19.5 | 169  | 340   | 111   | 1.54  | 93.7 | 14.3 | 109  | 146  | 94.9  | 312      |
| 1918       | 7.0  | 0.7  | 11.0 | 29.5 | 23.1  | 27.5  | 20.5  | 3.6  | 11.7 | 14.1 | 199  | 9.5   | *80.1    |
| 1919       | 6.29 | 30.1 | 31.7 | 7.71 | 201   | 34.9  | 29.4  | 10.5 | 2.09 | 434  | 23   | *479  | *135     |
| 1924       | 21.1 | 8.1  | 4.0  | 4.3  | 4.1   | 4.1   | 3.0   | 2.0  | 1.2  | 6.7  | 14.1 | 15.3  | 18.7     |
| 1935       | 3.5  | 14.2 | 33.5 | 136  | 506   | 242   | 34.0  | 3.9  | 14.1 | 56.1 | 190  | 141   | 109      |
| 1936       | 4.0  | 5.9  | 5.0  | 6.0  | 28.5  | 20.3  | 8.5   | 5.3  | 4.3  | 61.5 | 157  | 65.7  | 37.9     |
| 1937       | 9.9  | 5.0  | 17.2 | 70.6 | 1,040 | 680   | 35.0  | 21.1 | 21.1 | 35.3 | 20.7 | 150   | 150      |
| 1938       | 9.1  | 7.6  | 6.6  | 4.4  | 3.4   | 417   | 6.0   | 1.6  | 0    | 0    | 0.0  | 7.4   | 40       |
| 1939       | 4.13 | 1.03 | 87.2 | 6.59 | 22.0  | 30.6  | 10.8  | 0    | 0    | 0    | 12.9 | 292   | 41.3     |
| 1940       | 5.29 | 0.86 | 0.49 | 2.75 | 43.6  | 3.07  | 21.8  | 0.67 | 13.0 | 5.76 | 20.5 | 27.9  | 13.9     |
| 1941       | 60.2 | 5.5  | 309  | 180  | 305   | 1,202 | 1,143 | 63.4 | 14.1 | 73.4 | 66.7 | 33.0  | 269      |
| 1942       | 24.4 | 13.2 | 64.7 | 47.3 | 25.7  | 32.4  | 17.6  | 2.5  | 0    | 10.4 | 57.7 | 55.0  | 30.2     |
| 1943       | 19.8 | 11.4 | 7.9  | 26.5 | 1.15  | 35.9  | 2.6   | 1.5  | 0    | 109  | 27.1 | 30.2  | 30.2     |
| 1944       | 10.8 | 6.4  | 4.0  | 3.5  | 218   | 321   | 43.5  | 8.3  | 0    | 19.2 | 32.2 | 36.5  | 53.2     |
| 1945       | 3.2  | 11.0 | 15.1 | 23.9 | 94.4  | 324   | 70.4  | 8.1  | 17.3 | 37.1 | 65.7 | 4.1   | 56.2     |
| 1946       | 22.6 | 7.0  | 10.6 | 4.4  | 3.3   | 2.4   | 1.6   | 0    | 1.5  | 22.0 | 65.9 | 38.8  | 15.2     |
| 1947       | 8.9  | 11.7 | 31.0 | 8.9  | 3.0   | 1.6   | 0     | 2.6  | 1.1  | 1.0  | 62.9 | 1.2   | 10.5     |
| 1948       | .6   | .5   | 2.5  | 1.1  | 1.4   | .9    | .7    | .05  | 3.4  | 3.4  | 73.0 | .7    | 7.2      |
| 1949       | .8   | .6   | 11.7 | 252  | 133   | 87.2  | 29.1  | 0    | 15.7 | 16.2 | 7.9  | 35.3  | 49.5     |
| 1950       | 65.1 | 3.6  | 9.0  | 4.1  | 9.7   | 14.9  | 2.3   | 0    | .6   | 50.3 | 8.1  | .4    | 14.2     |

\* Revised.

Monthly and yearly runoff, in acre-feet

| Water year | Oct.   | Nov.  | Dec.   | Jan.   | Feb.   | Mar.   | Apr.   | May   | June  | July   | Aug.   | Sept.  | The year |
|------------|--------|-------|--------|--------|--------|--------|--------|-------|-------|--------|--------|--------|----------|
| 1915       | 2,690  | 434   | 10,070 | 73,640 | 48,340 | 9,150  | 2,460  | 9,940 | 547   | 5,444  | 3,660  | 2,430  | *168,800 |
| 1916       | 100    | 2,130 | 14,990 | 37,600 | 33,170 | 31,030 | 8,060  | 1,600 | 111   | 1,470  | 3,000  | 7,130  | *61,100  |
| 1917       | 12,410 | 990   | 1,200  | 33,670 | 10,900 | 6,000  | 93,290 | 5,760 | 851   | 63,070 | 0,900  | 5,600  | 240,400  |
| 1918       | 400    | 500   | 1,670  | 3,660  | 1,370  | 16,600 | 1,200  | 230   | 813   | 860    | 22,600 | 800    | 60,330   |
| 1919       | 307    | 1,790 | 1,950  | 470    | 11,100 | 3,370  | 1,730  | 640   | 177   | 26,600 | 13,670 | 20,500 | *70,570  |
| 1924       | 1,100  | 490   | 297    | 265    | 220    | 370    | 220    | 170   | 192   | 303    | 8,690  | 910    | 13,510   |
| 1935       | 210    | 847   | 2,060  | 8,340  | 28,110 | 14,910 | 2,070  | 240   | 840   | 3,450  | 9,250  | 8,400  | 70,730   |
| 1936       | 210    | 351   | 155    | 370    | 1,640  | 1,250  | 500    | 320   | 251   | 9,610  | 9,660  | 3,910  | 21,890   |
| 1937       | 600    | 290   | 1,060  | 4,340  | 58,200 | 41,330 | 2,130  | 50    | 1,430 | 1,300  | 2,170  | 1,230  | 110,600  |
| 1938       | 560    | 453   | 1,007  | 271    | 130    | 25,670 | 357    | 100   | 0     | 0      | 400    | 443    | 28,940   |
| 1939       | 260    | 104   | 5,160  | 1,050  | 1,250  | 1,880  | 640    | 0     | 0     | 0      | 2,640  | 17,370 | 29,720   |
| 1940       | 325    | 527   | 500    | 160    | 2,510  | 100    | 1,300  | 530   | 776   | 354    | 1,260  | 1,600  | 10,120   |

\* Revised.

1/ Published as "near Glendale, Ariz.", prior to 1920.



| Water year | Oct.  | Nov.  | Dec.   | Jan.   | Feb.   | Mar.   | Apr.   | May   | June  | July  | Aug.  | Sept. | The year |
|------------|-------|-------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|----------|
| 1941       | 3,700 | 370   | 19,000 | 11,530 | 16,940 | 71,140 | 68,240 | 0,010 | 037   | 4,510 | 4,100 | 1,960 | 209,760  |
| 1942       | 3,500 | 700   | 1,000  | 2,700  | 2,400  | 2,400  | 1,000  | 1,500 | 0     | 0     | 0     | 0     | 21,500   |
| 1943       | 1,200 | 670   | 1,000  | 1,100  | 1,000  | 1,000  | 1,000  | 1,000 | 0     | 0     | 0     | 0     | 7,900    |
| 1944       | 660   | 700   | 200    | 210    | 1,000  | 19,700 | 1,000  | 0     | 0     | 0     | 0     | 0     | 21,500   |
| 1945       | 190   | 850   | 900    | 1,470  | 5,000  | 19,900 | 4,000  | 400   | 1,000 | 4,000 | 0     | 0     | 40,700   |
| 1946       | 1,300 | 410   | 600    | 270    | 100    | 100    | 100    | 0     | 90    | 1,300 | 4,000 | 710   | 10,770   |
| 1947       | 600   | 1,200 | 1,200  | 700    | 100    | 100    | 100    | 150   | 60    | 1,000 | 3,000 | 700   | 7,570    |
| 1948       | 30    | 200   | 1,000  | 500    | 0      | 0      | 0      | 30    | 20    | 200   | 4,000 | 0     | 5,300    |
| 1949       | 400   | 100   | 710    | 15,000 | 7,000  | 5,300  | 1,700  | 0     | 900   | 400   | 2,100 | 0     | 25,200   |
| 1950       | 1,000 | 210   | 550    | 250    | 0      | 900    | 1,700  | 0     | 30    | 3,000 | 400   | 20    | 6,380    |

| Year | W.S.P.<br>No. | Water year ending Sept. 30 |               |                |       | Calendar year          |                                |
|------|---------------|----------------------------|---------------|----------------|-------|------------------------|--------------------------------|
|      |               | Momentary maximum          |               | Minimum<br>day | Mean  | Runoff in<br>acre-feet | Mean<br>Runoff in<br>acre-feet |
|      |               | Discharge                  | Date          |                |       |                        |                                |
| 1915 | 409,1213      | -                          | -             | 2              | *233  | *160,000               | *239                           |
| 1916 | 439,1213      | 105,000                    | Jan. 20, 1916 | 2              | *663  | *461,100               | *659                           |
| 1917 | 459           | -                          | -             | 5              | 332   | 240,400                | 314                            |
| 1918 | 1049,1213     | -                          | -             | 2              | *68.1 | *49,310                | *71.5                          |
| 1919 | 509,1213      | -                          | -             | .6             | *125  | *90,570                | -                              |
| 1934 | 879           | -                          | -             | -              | 10.7  | 13,530                 | 20.1                           |
| 1935 | 879           | -                          | -             | -              | 109   | 70,730                 | 106                            |
| 1936 | 879           | -                          | -             | -              | 37.9  | 23,880                 | 34.3                           |
| 1937 | 879           | -                          | -             | -              | 150   | 114,600                | 150                            |
| 1938 | 879           | -                          | -             | -              | 40.0  | 20,940                 | 48.9                           |
| 1939 | 879           | -                          | -             | -              | 41.3  | 29,470                 | 35.3                           |
| 1940 | 899           | -                          | -             | -              | 33.9  | 10,120                 | 43.0                           |
| 1941 | 929           | -                          | -             | -              | 209   | 209,200                | 266                            |
| 1942 | 959           | -                          | -             | -              | 30.2  | 21,050                 | 24.4                           |
| 1943 | 979           | -                          | -             | -              | 30.2  | 21,900                 | 26.0                           |
| 1944 | 1009          | -                          | -             | -              | 58.2  | 42,200                 | 58.9                           |
| 1945 | 1039          | -                          | -             | -              | 56.2  | 40,710                 | 57.2                           |
| 1946 | 1059          | -                          | -             | -              | 15.2  | 10,970                 | 15.3                           |
| 1947 | 1089          | -                          | -             | -              | 10.5  | 7,580                  | 5.873                          |
| 1948 | 1119          | -                          | -             | -              | 7.2   | 5,210                  | 6.0                            |
| 1949 | 1149          | -                          | -             | -              | 14.6  | 15,350                 | 54.3                           |
| 1950 | 1179          | -                          | -             | -              | 14.2  | 10,260                 | -                              |

Note.--A maximum discharge of about 105,000 cfs occurred Nov. 27, 1914 (see Extremes paragraph on preceding page).

791. Lake Pleasant at Lake Pleasant Dam, Ariz.

Location.--Lat 33°51', long. 112°16', in NW sec. 21, T. 6 N., R. 1 E., at left end of Lake Pleasant Dam on Agua Fria River.

Drainage area.--1,400 sq mi, approximately.

Dam.--Staff gage. Datum of gage is 1,431.2 ft above mean sea level, datum of 1929.

Extremes.--1928-80: Maximum contents, 178,500 acre-ft Apr. 19, 1941 (gage height, 170.13 ft), of which 500 acre-ft was uncontrolled storage; no storage Sept. 6, 1933, July 19 to Aug. 13, 1940.

Remarks.--Lake is formed by multiple-arch dam; dam completed and storage began in 1927. Capacity prior to alteration of dam in 1936 was 103,000 acre-ft; capacity after alteration was 164,500 acre-ft between gage heights 34 ft (revised, center line of outlet works) and 170 ft (top of spillway gates). Capacity has gradually diminished because of sedimentation. Capacity by table used since Oct. 1, 1948, was 163,600 acre-ft between gage heights 59 ft (25 ft above center line of outlet works) and 170.0 ft (top of spillway gates). Since 1948 there has been no storage below gage height 59 ft because of accumulated sediment. Water released from reservoir flows down river channel 1 mile to diversion dam where it is diverted for irrigation near Beardsley. Figures given herein represent usable contents in Lake Pleasant. Contents of small reservoirs formed by diversion dam is not included. Complete record of monthly contents is not available prior to water year 1939.

Contents, in acre-feet, on last day of month

[illegible]

Contents, in acre-feet, on last day of month of Lake Pleasant at Lake Pleasant Dam, Ariz.--Continued

| Water year | Oct.   | Nov.   | Dec.   | Jan.   | Feb.   | Mar.    | Apr.    | May     | June    | July    | Aug.    | Sept.  |
|------------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|--------|
| 1936       | -      | -      | 13,000 | -      | -      | -       | -       | -       | -       | -       | -       | 6,770  |
| 1937       | -      | -      | 5,753  | -      | -      | -       | -       | -       | -       | -       | -       | 2,663  |
| 1938       | -      | -      | 2,210  | -      | -      | -       | -       | -       | -       | -       | -       | 2,210  |
| 1939       | 1,960  | 1,810  | 6,750  | 7,050  | 8,190  | 9,860   | 8,570   | 6,050   | 2,730   | 1,330   | 1,070   | 19,170 |
| 1940       | 49,700 | 8,720  | 7,280  | 7,270  | 9,730  | 9,470   | 2,510   | 2,010   | 2,660   | 0       | 1,150   | 661    |
| 1941       | 1,760  | 261    | 10,200 | 10,000 | 47,800 | 121,700 | 178,100 | 173,000 | 156,700 | 116,500 | 116,000 | 97,900 |
| 1942       | 93,000 | 90,400 | 93,000 | 93,000 | 92,000 | 81,200  | 70,800  | 61,000  | 51,700  | 38,000  | 27,300  | 6,070  |
| 1943       | 2,510  | 1,150  | 970    | 2,550  | 2,150  | 4,860   | 4,610   | 4,600   | 4,100   | 4,200   | 9,000   | 6,970  |
| 1944       | 3,810  | 2,280  | 2,530  | 2,600  | 15,200 | 34,500  | 34,000  | 29,100  | 10,000  | 11,000  | 11,000  | 3,070  |
| 1945       | 619    | 1,100  | 1,980  | 3,420  | 6,750  | 20,200  | 27,700  | 19,000  | 11,600  | 6,000   | 7,100   | 5,540  |
| 1946       | 4,150  | 3,160  | 3,290  | 3,500  | 3,600  | 3,610   | 3,550   | 4,87    | 4,37    | 2,650   | 5,490   | 7,550  |
| 1947       | 1,790  | 1,210  | 2,100  | 2,950  | 3,640  | 3,020   | 470     | 513     | 448     | 367     | 1,510   | 159    |
| 1948       | 572    | 81     | 210    | 241    | 292    | 296     | 268     | 279     | 105     | 215     | 107     | 154    |
| 1949       | 131    | 121    | 610    | 16,200 | 23,100 | 28,300  | 29,300  | 28,000  | 24,700  | 11,200  | 6,600   | 1,550  |
| 1950       | 5,090  | 5,110  | 5,530  | 5,600  | 6,090  | 6,790   | 6,620   | 6,210   | 5,010   | 5,660   | 2,200   | 218    |

a Contents by capacity table used beginning Oct. 1, 1939; contents Oct. 31, 1939, by capacity table used prior to Oct. 1, 1939, were 16,000 acre-ft.

b Contents by capacity table used beginning Oct. 1, 1947; contents Oct. 31, 1947, by capacity table used prior to Oct. 1, 1947, were 500 acre-ft.



## 5125. Agua Fria River near Mayer, Ariz.

Location.--Lat 34°19', long 112°04', in NW1/4 sec. 20, T.11 N., R.3 E., on left bank at Sycamore damsite, 700 ft downstream from Bigbug Creek and 12 miles southeast of Mayer.

Drainage area.--568 sq mi.

Records available.--January 1940 to September 1960.

Gage.--Water-stage recorder. Datum of gage is 3,434 ft (levels by Maricopa County Municipal Water Conservation District No. 1).

Average discharge (unadjusted).--20 years (1940-60), 14.2 cfs (10,280 acre-ft per year); median of yearly mean discharges, 10 cfs (7,200 acre-ft per year).

Extremes.--1940-60: Maximum discharge, 13,000 cfs Mar. 1, 1941, from rating curve extended above 1,500 cfs on basis of slope-area measurement of peak flow; maximum gage height, 12.00 ft Aug. 3, 1955; negligible flow at times during summer months in most years when entire flow was diverted to Perry Canal above station and flow past gage was seepage only.

Remarks.--Diversions above station for mining and irrigation of about 650 acres. For total flow of river at Sycamore damsite, see last table below showing combined flow of Agua Fria River and of Perry Canal, which diverts just above station.

Monthly and yearly mean discharge, in cubic feet per second

| Water year | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sept. | The year |
|------------|------|------|------|------|------|------|------|------|------|------|------|-------|----------|
| 1951       | 0.14 | 0.10 | 0.08 | 0.07 | 0.02 | 0.01 | 0    | 0.03 | 0.06 | 7.79 | 24.4 | 22.0  | 23.3     |
| 1952       | 32.7 | 1.03 | 20.4 | 89.3 | 4.53 | 80.7 | 6.10 | .69  | .70  | 3.61 | 33.9 | 17.4  | 24.6     |
| 1953       | .75  | 4.41 | 3.54 | 2.90 | 1.66 | .69  | .97  | .40  | 20.0 | 15.6 | .46  |       | 5.16     |
| 1954       | .49  | .59  | .67  | 1.02 | 1.64 | 44.4 | 2.07 | .29  | 2.75 | 11.4 | 14.0 | 16.5  | 6.44     |
| 1955       | 1.03 | .84  | 1.03 | 2.07 | 2.66 | .60  | .23  | .25  | 22.9 | 40.2 | 159  | 1.09  | 20.3     |
| 1956       | 3.95 | 1.30 | 1.99 | 1.53 | .55  | .55  | .41  | .53  | 5.63 | 27.9 | 6.43 | .26   | 4.31     |
| 1957       | .20  | .39  | .39  | 22.7 | 15.8 | 2.62 | 1.43 | .29  | 1.66 | 11.6 | 17.7 | .33   | 6.09     |
| 1958       | 2.17 | 14.4 | 1.37 | 1.34 | 22.9 | 29.6 | 4.24 | 1.04 | 10.6 | 4.43 | 37.1 | 42.2  | 13.9     |
| 1959       | 1.16 | 1.21 | 1.40 | 1.05 | 4.81 | 1.83 | 1.01 | .49  | .34  | 31.1 | 121  | .61   | 14.2     |
| 1960       | 1.01 | 1.37 | 61.6 | 46.0 | 4.66 | 3.11 | 2.5  | 2.5  | 2.35 | .15  | 17.4 | 10.7  | 12.9     |

Monthly and yearly discharge, in acre-feet

| Water year | Oct.  | Nov. | Dec.  | Jan.  | Feb.  | Mar.  | Apr. | May | June  | July  | Aug.   | Sept. | The year |
|------------|-------|------|-------|-------|-------|-------|------|-----|-------|-------|--------|-------|----------|
| 1951       | 6.7   | 6.0  | 4.0   | 4.4   | 1.2   | 0.4   | 0    | 2.0 | 3.4   | 479   | 14,990 | 1,360 | 16,850   |
| 1952       | 2,010 | 109  | 1,250 | 5,490 | 260   | 4,960 | 363  | 55  | 42    | 232   | 7,090  | 1,040 | 17,880   |
| 1953       | 46    | 262  | 216   | 172   | 89    | 102   | 53   | 60  | 24    | 1,720 | 959    | 20    | 3,750    |
| 1954       | 50    | 55   | 64    | 112   | 91    | 2,750 | 171  | 16  | 163   | 700   | 909    | 1,100 | 6,110    |
| 1955       | 65    | 50   | 63    | 120   | 147   | 49    | 14   | 16  | 1,360 | 2,970 | 9,600  | 65    | 14,900   |
| 1956       | 243   | 82   | 122   | 94    | 32    | 54    | 24   | 33  | 330   | 1,720 | 395    | 16    | 3,570    |
| 1957       | 12    | 23   | 39    | 1,410 | 766   | 161   | 86   | 71  | 121   | 716   | 1,090  | 20    | 4,520    |
| 1958       | 133   | 659  | 84    | 84    | 1,270 | 1,820 | 252  | 64  | 629   | 27    | 2,260  | 2,550 | 10,100   |
| 1959       | 71    | 72   | 86    | 114   | 267   | 153   | 117  | 48  | 30    | 1,910 | 7,470  | 36    | 10,370   |
| 1960       | 62    | 62   | 3,790 | 2,830 | 260   | 191   | 149  | 154 | 140   | 9.5   | 1,070  | 634   | 9,380    |

Yearly discharge, in cubic feet per second

| Year | WSP  | Water year ending Sept. 30 |               |             |      | Calendar year |      |           |        |
|------|------|----------------------------|---------------|-------------|------|---------------|------|-----------|--------|
|      |      | Momentary maximum          |               | Minimum day | Mean | Acre-feet     | Mean | Acre-feet |        |
|      |      | Discharge                  | Date          |             |      |               |      |           |        |
| 1950 |      |                            |               |             |      |               |      |           | 2,720  |
| 1951 | 1213 | 6,180                      | Aug. 28, 1951 | 0           | 23.3 | 16,850        | 3.76 |           | 20,200 |
| 1952 | 1243 | 7,500                      | Jan. 18, 1952 | .3          | 24.6 | 17,880        | 20.7 |           | 15,040 |
| 1953 | 1263 | 5,510                      | July 8, 1953  | .2          | 5.16 | 3,750         | 4.59 |           | 3,330  |
| 1954 | 1343 | 4,570                      | Sept. 3, 1954 | .1          | 8.44 | 6,110         | 8.53 |           | 6,170  |
| 1955 | 1393 | 12,000                     | Aug. 3, 1955  | .2          | 20.3 | 14,900        | 20.7 |           | 15,000 |
| 1956 | 1443 | 6,080                      | July 25, 1956 | .2          | 4.31 | 3,130         | 3.70 |           | 2,740  |
| 1957 | 1513 | 2,710                      | Aug. 13, 1957 | .1          | 6.09 | 4,400         | 7.49 |           | 5,420  |
| 1958 | 1563 | 4,620                      | June 21, 1958 | .2          | 13.9 | 10,050        | 12.7 |           | 9,200  |
| 1959 | 1633 | 9,700                      | Aug. 4, 1959  | .3          | 14.2 | 10,280        | 19.3 |           | 13,950 |
| 1960 | 1713 | 4,820                      | Aug. 8, 1960  | .1          | 12.9 | 9,380         |      |           |        |

Monthly and yearly combined discharge, in acre-feet

| Water year | Oct.  | Nov. | Dec.  | Jan.  | Feb.  | Mar.  | Apr. | May | June  | July  | Aug.   | Sept. | The year |
|------------|-------|------|-------|-------|-------|-------|------|-----|-------|-------|--------|-------|----------|
| 1951       | 22    | 37   | 55    | 62    | 93    | 119   | 101  | 50  | 33    | 490   | 14,900 | 1,360 | 17,430   |
| 1952       | 2,020 | 109  | 1,260 | 5,490 | 260   | 4,960 | 405  | 165 | 100   | 231   | 2,090  | 1,040 | 18,130   |
| 1953       | 46    | 262  | 201   | 172   | 89    | 102   | 53   | 60  | 24    | 1,730 | 959    | 20    | 4,230    |
| 1954       | 50    | 55   | 64    | 112   | 91    | 2,740 | 197  | 16  | 162   | 700   | 909    | 1,100 | 6,730    |
| 1955       | 65    | 50   | 63    | 120   | 147   | 49    | 14   | 16  | 1,360 | 2,970 | 9,600  | 65    | 14,900   |
| 1956       | 243   | 82   | 122   | 150   | 150   | 159   | 113  | 61  | 350   | 1,720 | 395    | 16    | 3,570    |
| 1957       | 12    | 23   | 39    | 1,410 | 766   | 161   | 86   | 71  | 121   | 716   | 1,090  | 20    | 4,520    |
| 1958       | 133   | 659  | 84    | 84    | 1,260 | 1,820 | 252  | 64  | 644   | 27    | 2,260  | 2,550 | 10,100   |
| 1959       | 71    | 72   | 86    | 114   | 267   | 153   | 117  | 48  | 30    | 1,910 | 7,470  | 36    | 10,370   |
| 1960       | 62    | 62   | 3,790 | 2,830 | 260   | 191   | 149  | 154 | 140   | 9.5   | 1,070  | 634   | 9,380    |

† Corrected.



## 5130. Agua Fria River at Lake Pleasant Dam, Ariz.

**Location.**--Lat 33°51', long 112°16', in NW 1/4 sec. 21, T.6 N., R.1 E., at left upstream end of Lake Pleasant Dam, 23 miles northwest of Glendale and 24 1/2 miles upstream from New River.

**Drainage area.**--1,459 sq mi.

**Records available.**--November 1910 to September 1914 (gauge heights only), October 1914 to September 1919, October 1919 to September 1934 (gauge heights only), October 1934 to September 1960 (monthly discharge only). Published as "near Glendale" prior to 1930.

**Gage.**--Staff gage on Lake Pleasant. Datum of gage is 1,431.2 ft above mean sea level, datum of 1929. Prior to Sept. 30, 1924, staff gage or water-stage recorder at several sites in vicinity of diversion dam 1 1/2 miles downstream from Lake Pleasant Dam at different datum.

**Average discharge.**--32 years (1914-19, 1935-60), 90.1 cfs (65,230 acre-ft per year); median of yearly mean discharges, 43 cfs (31,100 acre-ft per year).

**Extremes.**--1910-24, 1935-60: Maximum discharge, about 105,000 cfs Jan. 28, 1916 (gage height, 30 ft, same datum as in 1919, from floodmarks), Nov. 27, 1919 (gage height, 33 ft, datum then in use, from floodmarks), from rating curve extended above 15,000 cfs on basis of velocity-area studies (on basis of comparative gage heights, the flood of Nov. 27, 1919, is believed to have been the greater); no flow during spring and summer of several years.

**Remarks.**--Figures herein represent flow into Lake Pleasant. Discharge computed on basis of three factors as follows: 1. Change in contents of Lake Pleasant and in contents of small reservoir behind diversion dam 1 1/2 miles downstream from Lake Pleasant. 2. (a) Release from Lake Pleasant computed from twice-daily readings by Clausen-Pierce weir rule and release hydrograph. Weir rule readings checked by current meter measurements by U. S. Geological Survey; (b) spill from Lake Pleasant as measured over diversion dam (none since May 13, 1941). 3. Effect of rainfall and evaporation on lake; evaporation assumed as 0.85 of that measured once daily in 3-foot square tank pan buried 1 1/2 ft in ground near left end of Lake Pleasant Dam. Effect of bank storage and bank release in Lake Pleasant is not taken into account. For months when inflow to lake is small and other factors relatively large, discordant figures of runoff may appear. Such discrepancies that may be attributed to inaccuracies in the capacity table or to the fact that bank storage and bank release are not taken into account, result in quantities too large for periods of falling stage but are compensated for by quantities too small for periods of rising stage. Inaccuracies in figures of release and evaporation, which may be within reasonable limits within themselves, may result in proportionally large inaccuracies in small figures of inflow computed as residuals. Diversions for irrigation above Lake Pleasant of probably not over 1,000 acres. Records of chemical analyses for the period December 1950 to September 1958 and water temperatures for the period January 1952 to September 1958 are published in reports of Geological Survey.

**Cooperation.**--Records collected and prepared in cooperation with Maricopa County Municipal Water Conservation District No. 1.

Monthly and yearly mean discharge, in cubic feet per second

| Water year | Oct. | Nov. | Dec. | Jan.  | Feb. | Mar. | Apr. | May  | June | July | Aug.  | Sept. | The year |
|------------|------|------|------|-------|------|------|------|------|------|------|-------|-------|----------|
| 1951       | 1.2  | 0.9  | 0.0  | 12.7  | 1.7  | 1.4  | 7.0  | 1.4  | 0    | 12.7 | 1,606 | 9.4   | 144      |
| 1952       | 0    | 51.2 | 31.0 | 294   | 17.7 | 340  | 82.7 | 15.0 | 0    | 30.4 | 75.3  | 26.6  | 61.9     |
| 1953       | 5.1  | 8.6  | 10.5 | 6.1   | 3.3  | 10.6 | 5.9  | 1.04 | 21.2 | 91.9 | 47.4  | 6.2   | 16.0     |
| 1954       | 1.4  | 3.2  | 2.6  | 5.0   | 4.0  | 215  | 21.0 | 4.9  | 9.5  | 50.7 | 77.7  | 49.1  | 35.9     |
| 1955       | .9   | 1.7  | 2.2  | 5.7   | 4.1  | 5.4  | 3.5  | 2.4  | 60.0 | 102  | 271   | 6.0   | 39.1     |
| 1956       | 3.0  | 1.9  | 3.6  | 3.2   | 3.0  | 5.2  | 3.2  | 3.2  | 9.3  | 54.4 | 14.0  | 0     | 6.6      |
| 1957       | 2.3  | 2.1  | 2.7  | 100.6 | 79.9 | 16.7 | 2.5  | 2.4  | 4.1  | 3.6  | 3.0   | 0     | 25.1     |
| 1958       | 4.16 | 74.3 | 5.73 | 3.34  | 91.8 | 162  | 41.2 | 1.07 | 9.20 | 0    | 24.1  | 204   | 50.9     |
| 1959       | 4.96 | 1.63 | 2.01 | 3.30  | 11.6 | 4.60 | 1.01 | 3.98 | 15.8 | 222  | 0     | 0     | 23.0     |
| 1960       | 63.4 | 12.2 | 314  | 140   | 34.2 | 29.0 | 6.85 | 5.55 | 7.61 | 9.01 | 74.0  | 20.4  | 62.0     |

Monthly and yearly discharge, in acre-feet

| Water year | Oct.  | Nov.  | Dec.   | Jan.   | Feb.  | Mar.   | Apr.  | May | June  | July  | Aug.    | Sept.  | The year |
|------------|-------|-------|--------|--------|-------|--------|-------|-----|-------|-------|---------|--------|----------|
| 1951       | 71    | 56    | 47     | 779    | 68    | 69     | 116   | 83  | 0     | 761   | 101,000 | 562    | 104,500  |
| 1952       | 0     | 3,050 | 1,960  | 16,080 | 1,020 | 21,430 | 4,920 | 971 | 0     | 1,470 | 4,630   | 1,606  | 59,450   |
| 1953       | 315   | 502   | 647    | 374    | 165   | 645    | 350   | 113 | 1,260 | 5,650 | 2,610   | 371    | 13,630   |
| 1954       | 65    | 192   | 160    | 355    | 255   | 13,210 | 1,390 | 299 | 567   | 1,890 | 4,760   | 2,920  | 26,010   |
| 1955       | 85    | 99    | 134    | 352    | 228   | 329    | 207   | 147 | 3,450 | 6,260 | 16,660  | 359    | 26,350   |
| 1956       | 182   | 111   | 222    | 194    | 205   | 316    | 192   | 195 | 553   | 3,345 | 901     | 0      | 6,416    |
| 1957       | 141   | 125   | 166    | 11,120 | 4,440 | 1,150  | 140   | 146 | 246   | 223   | 235     | 0      | 16,140   |
| 1958       | 216   | 4,410 | 229    | 205    | 6,060 | 9,960  | 2,410 | 115 | 147   | 0     | 1,400   | 12,140 | 36,670   |
| 1959       | 305   | 109   | 173    | 208    | 642   | 795    | 60    | 241 | 30    | 970   | 13,670  | 0      | 16,670   |
| 1960       | 8,120 | 776   | 19,700 | 6,670  | 1,970 | 1,720  | 410   | 241 | 405   | 654   | 4,190   | 1,010  | 45,100   |

Yearly discharge, in cubic feet per second

| Year | WSP  | Water year ending Sept. 30 |      |             |      | Calendar year |      |           |         |
|------|------|----------------------------|------|-------------|------|---------------|------|-----------|---------|
|      |      | Momentary maximum          |      | Minimum day | Mean | Acre-feet     | Mean | Acre-feet |         |
|      |      | Discharge                  | Date |             |      |               |      |           |         |
| 1950 | -    | -                          | -    | -           | -    | -             | 7.0  | -         | 5,670   |
| 1951 | 1233 | -                          | -    | -           | 144  | 104,500       | 151  | -         | 109,200 |
| 1952 | 1743 | -                          | -    | -           | 61.9 | 59,450        | 77.1 | -         | 55,970  |
| 1953 | 1293 | -                          | -    | -           | 16.0 | 13,630        | 16.6 | -         | 12,000  |
| 1954 | 1243 | -                          | -    | -           | 25.9 | 26,010        | 35.7 | -         | 25,000  |
| 1955 | 1323 | -                          | -    | -           | 39.1 | 26,350        | 39.4 | -         | 19,550  |
| 1956 | 1443 | -                          | -    | -           | 6.6  | 6,416         | 8.7  | -         | 6,230   |
| 1957 | 1613 | -                          | -    | -           | 25.1 | 16,140        | 31.2 | -         | 22,000  |
| 1958 | 1663 | -                          | -    | -           | 50.6 | 36,670        | 4.10 | -         | 32,860  |
| 1959 | 1633 | -                          | -    | -           | 23.0 | 16,660        | 59.6 | -         | 41,200  |
| 1960 | 1713 | -                          | -    | -           | 62.8 | 45,500        | -    | -         | -       |



## 5135. Lake Pleasant at Lake Pleasant Dam, Ariz.

Location.--Lat 33°51', long 112°16', in NW 1/4 sec. 21, T. 6 N., R. 1 E., at left upstream end of Lake Pleasant Dam on Agua Fria River.

Drainage area.--1,460 sq mi, approximately.

Records available.--February 1928 to September 1960 (annual contents only, prior to 1959).

Gage.--Staff gage. Datum of gage is 1,431.2 ft above mean sea level, datum of 1929.

Extremes.--1928-60: Maximum contents, 178,500 acre-ft Apr. 19, 1941 (gage height, 170.13 ft), of which 500 acre-ft was uncontrolled storage; no storage Sept. 3, 1933, July 19 to Aug. 13, 1940.

Remarks.--Lake is formed by multiple-arch dam; dam completed and storage begun in 1927. Capacity, 163,800 acre-ft between gage heights 59 (25 ft above center line of outlet works) and 170.0 ft (top of spillway gates). There is no storage below gage height 59 ft because of accumulated sediment. Water released from reservoir flows down river channel 1 1/2 miles to diversion dam where it is diverted for irrigation near Bearisley. Figures given herein represent usable contents in Lake Pleasant. Contents of small reservoir formed by diversion dam is not included.

Cooperation.--Gage-height record furnished by Maricopa County Municipal Water Conservation District No. 1.

Contents, in acre-feet, on last day of month

| Water year | Oct.   | Nov.    | Dec.    | Jan.    | Feb.    | Mar.    | Apr.    | May     | June    | July    | Aug.    | Sept.   |
|------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1951       | 211    | 203     | 207     | 944     | 1,000   | 1,600   | 1,060   | 1,020   | 856     | 1,400   | 161,900 | 160,900 |
| 1952       | 98,000 | 100,300 | 101,000 | 119,200 | 128,300 | 137,600 | 139,300 | 135,000 | 125,300 | 109,200 | 94,100  | 64,000  |
| 1953       | 82,300 | 82,240  | 82,460  | 82,240  | 81,720  | 77,620  | 74,910  | 72,160  | 61,050  | 49,460  | 37,190  | 33,700  |
| 1954       | 33,040 | 32,740  | 32,470  | 32,710  | 32,580  | 45,000  | 44,660  | 43,110  | 37,560  | 30,430  | 26,580  | 23,970  |
| 1955       | 23,460 | 23,160  | 22,960  | 23,290  | 23,150  | 22,920  | 22,400  | 21,750  | 20,660  | 20,630  | 34,900  | 29,060  |
| 1956       | 26,410 | 23,020  | 27,920  | 27,000  | 27,760  | 27,420  | 26,810  | 26,030  | 21,090  | 17,720  | 12,660  | 9,600   |
| 1957       | 9,370  | 9,130   | 9,010   | 20,080  | 24,340  | 25,060  | 24,520  | 23,900  | 21,320  | 15,360  | 9,490   | 3,170   |
| 1958       | 3,320  | 7,560   | 7,630   | 7,620   | 12,550  | 22,320  | 24,260  | 23,560  | 21,400  | 15,020  | 9,680   | 10,610  |
| 1959       | 10,460 | 10,260  | 10,030  | 10,020  | 10,520  | 16,270  | 17,770  | 17,360  | 16,030  | 10,840  | 20,420  | 14,400  |
| 1960       | 19,100 | 19,460  | 30,760  | 47,160  | 48,740  | 49,680  | 46,900  | 47,650  | 44,100  | 37,060  | 32,290  | 27,790  |



## 5125. Agua Fria River near Mayer, Ariz.

Location.--Lat 34°19', long 112°04', in NW1/4 sec. 20, T.11 N., R.3 E., at Sycamore damsite, 700 ft downstream from Bigbug Creek and 12 miles southeast of Mayer.

Drainage area.--588 sq mi.

Gage.--Nonrecording Jan. 24 to Feb. 14, 1940; recording thereafter. Altitude of gage is 3,434 ft (levels by Maricopa County Municipal Water Conservation District No. 1).

Stage-discharge relation.--Defined by current-meter measurements below 5,600 cfs and extended above on basis of slope-area measurements at gage heights 9.3, 9.44, and 11.97 ft.

Remarks.--Peak discharges unaffected by small diversions for mining and irrigation. Base for partial-duration series, 1,300 cfs.

## Peak stages and discharges

| Water year | Date           | Gage height (feet) | Discharge (cfs) | Water year | Date           | Gage height (feet) | Discharge (cfs) |
|------------|----------------|--------------------|-----------------|------------|----------------|--------------------|-----------------|
| 1940       | Feb. 2, 1940   | 5.7                | 1,820           | 1952       | Aug. 16, 1952  | 5.35               | 2,320           |
|            | June 26, 1940  | 8.80               | 5,920           |            | Aug. 24, 1952  | 5.50               | 2,510           |
|            | Aug. 18, 1940  | 7.27               | 3,620           | 1953       | July 8, 1953   | 7.23               | 5,510           |
|            | Sept. 2, 1940  | 8.55               | 5,500           |            | July 26, 1953  | 5.37               | 2,510           |
| 1941       | Oct. 5, 1940   | 5.78               | 1,900           |            | Aug. 28, 1953  | 5.02               | 1,860           |
|            | Dec. 24, 1940  | 9.30               | 6,030           | 1954       | July 22, 1954  | 4.85               | 1,320           |
|            | Dec. 30, 1940  | 5.59               | 1,810           |            | Aug. 4, 1954   | 5.76               | 2,360           |
|            | Mar. 1, 1941   | 11.97              | 13,000          |            | Aug. 5, 1954   | 6.14               | 2,910           |
|            | Mar. 14, 1941  | 9.43               | 7,000           |            | Sept. 1, 1954  | 5.55               | 2,100           |
|            | Apr. 13, 1941  | 7.92               | 4,510           |            | Sept. 3, 1954  | 7.22               | 4,570           |
|            | July 18, 1941  | 5.85               | 2,010           |            | Sept. 24, 1954 | 5.11               | 1,530           |
|            | July 24, 1941  | 5.08               | 1,360           | 1955       | June 13, 1955  | 5.68               | 2,620           |
|            | Aug. 8, 1941   | 5.39               | 1,650           |            | July 15, 1955  | 5.45               | 1,990           |
|            | Sept. 17, 1941 | 5.14               | 6,430           |            | July 17, 1955  | 6.10               | 2,650           |
| 1942       | Oct. 20, 1941  | 6.00               | 2,190           |            | July 23, 1955  | 5.35               | 7,620           |
|            | July 25, 1942  | 5.08               | 1,300           |            | July 31, 1955  | 7.79               | 5,400           |
|            | Aug. 4, 1942   | 6.37               | 2,560           |            | Aug. 3, 1955   | 12.00              | 12,800          |
|            | Aug. 6, 1942   | 9.0                | 6,260           |            | Aug. 7, 1955   | 7.63               | 5,230           |
| 1943       | Aug. 9, 1943   | 4.79               | 1,340           |            | Aug. 8, 1955   | 6.80               | 3,920           |
|            | Aug. 15, 1943  | 4.78               | 1,310           |            | Aug. 9, 1955   | 5.80               | 2,870           |
|            | Sept. 23, 1943 | 6.70               | 3,500           |            | Aug. 12, 1955  | 4.86               | 1,450           |
|            |                |                    |                 |            | Aug. 14, 1955  | 5.40               | 2,040           |
| 1944       | Feb. 24, 1944  | 6.11               | 2,320           |            | Aug. 16, 1955  | 5.63               | 2,310           |
|            | Aug. 19, 1944  | 5.92               | 2,280           |            | Aug. 21, 1955  | 6.60               | 5,780           |
|            | Sept. 14, 1944 | 5.78               | 2,140           |            | Aug. 22, 1955  | 6.56               | 3,550           |
|            | Sept. 16, 1944 | 7.3                | 3,810           |            | Aug. 23, 1955  | 8.95               | 7,340           |
|            | Sept. 26, 1944 | 5.08               | 1,500           |            | Aug. 25, 1955  | 8.00               | 5,820           |
|            |                |                    |                 | 1956       | June 30, 1956  | 5.36               | 1,550           |
| 1945       | July 27, 1945  | 6.26               | 2,620           |            | July 11, 1956  | 6.47               | 2,840           |
|            | Aug. 10, 1945  | 6.10               | 2,460           |            | July 25, 1956  | 9.15               | 6,860           |
| 1946       | July 22, 1946  | 8.2                | 4,930           |            | July 30, 1956  | 6.10               | 2,370           |
|            | Aug. 10, 1946  | 5.53               | 1,570           |            | Aug. 17, 1956  | 5.20               | 1,370           |
|            | Aug. 14, 1946  | 6.26               | 2,350           | 1957       | Jan. 27, 1957  | 5.28               | 1,420           |
|            | Aug. 15, 1946  | 5.76               | 1,600           |            | July 6, 1957   | 5.75               | 1,900           |
|            | Aug. 30, 1946  | 7.0                | 3,230           |            | July 26, 1957  | 6.05               | 2,310           |
| 1947       | Aug. 16, 1947  | 5.57               | 1,610           |            | Aug. 11, 1957  | 6.18               | 2,410           |
|            | Aug. 31, 1947  | 5.38               | 1,430           |            | Aug. 13, 1957  | 6.37               | 2,710           |
| 1948       | Aug. 4, 1948   | 9.30               | 6,030           | 1958       | Feb. 4, 1958   | 5.77               | 1,880           |
|            | Aug. 6, 1948   | 7.15               | 3,490           |            | June 21, 1958  | 7.72               | 4,620           |
| 1949       | Jan. 13, 1949  | 6.37               | 2,460           |            | Aug. 20, 1958  | 5.71               | 1,790           |
|            |                |                    |                 |            | Sept. 12, 1958 | 6.94               | 3,490           |
| 1950       | Oct. 10, 1949  | 5.86               | 1,690           |            | Sept. 27, 1958 | 5.21               | 1,300           |
|            | July 17, 1950  | 6.10               | 2,170           |            | Sept. 29, 1958 | 6.28               | 2,530           |
|            | July 30, 1950  | 5.88               | 1,950           |            | Sept. 29, 1958 | 5.95               | 2,070           |
| 1951       | July 31, 1951  | 6.64               | 3,040           | 1959       | July 5, 1959   | 5.19               | 1,310           |
|            | Aug. 19, 1951  | 9.23               | 6,230           |            | July 12, 1959  | 6.50               | 2,800           |
|            | Aug. 26, 1951  | 9.70               | 8,180           |            | July 16, 1959  | 5.38               | 1,450           |
|            | Aug. 29, 1951  | 9.65               | 8,010           |            | July 26, 1959  | 8.57               | 5,910           |
|            | Sept. 7, 1951  | 7.16               | 4,380           |            | July 27, 1959  | 5.85               | 2,070           |
|            |                |                    |                 |            | Aug. 1, 1959   | 7.90               | 4,890           |
| 1952       | Oct. 1, 1951   | 5.70               | 2,770           |            | Aug. 4, 1959   | 10.78              | 9,700           |
|            | Oct. 30, 1951  | 7.38               | 5,260           |            | Aug. 11, 1959  | 9.91               | 8,170           |
|            | Dec. 30, 1951  | 5.20               | 2,140           |            | Aug. 13, 1959  | 9.50               | 7,470           |
|            | Jan. 18, 1952  | 8.85               | 7,500           |            | Aug. 24, 1959  | 6.00               | 2,350           |
|            | Mar. 11, 1952  | 5.78               | 2,900           | 1960       | Dec. 25, 1959  | 6.88               | 2,400           |
|            |                |                    |                 |            |                |                    |                 |
| 1960       | Aug. 8, 1960   | 7.85               | 4,820           | 1961       | July 26, 1961  | 6.15               | 2,560           |
|            | Aug. 22, 1960  | 5.85               | 2,070           |            | Aug. 1, 1961   | 5.75               | 2,070           |
|            | Sept. 1, 1960  | 5.23               | 1,400           |            | Aug. 6, 1961   | 5.10               | 1,320           |
| 1961       | Oct. 9, 1960   | 6.50               | 2,680           |            | Sept. 13, 1961 | 6.20               | 2,620           |
|            | July 14, 1961  | 5.29               | 1,460           |            | Sept. 17, 1961 | 11.00              | 10,100          |
|            | July 16, 1961  | 6.33               | 2,660           | 1962       | Sept. 13, 1962 | 6.68               | 2,470           |
|            | July 22, 1961  | 11.05              | 10,200          |            |                |                    |                 |



# MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NUMBER ONE

Recapitulation of Monthly Inflow Measured in Acre Feet at  
Lake Pleasant Storage Reservoir for Period from 1911-12 to March 31, 1968.

| Year    | Oct.   | Nov.    | Dec.   | Jan.    | Feb.    | March  | April   | May    | June   | July   | August | Sept.  | Total   |
|---------|--------|---------|--------|---------|---------|--------|---------|--------|--------|--------|--------|--------|---------|
| 1911-12 | 5,700  | 3,600   | 4,900  | 272     | 224     | 22,304 | 15,970  | 2,160  | 1,710  | 40,000 | 14,200 | 2,960  | 114,000 |
| 1912-13 | 10,321 | 484     | 1,572  | 295     | 14,910  | 9,418  | 17,000  | 306    | 140    | 3,762  | 292    | 10,000 | 68,500  |
| 1913-14 | 1,010  | 3,020   | 400    | 7,800   | 55,200  | 1,570  | 1,268   | 117    | 125    | 3,190  | 100    | 3,800  | 77,600  |
| 1914-15 | 2,060  | 430     | 10,080 | 60,000  | 45,300  | 8,130  | 9,160   | 9,900  | 600    | 55,440 | 26,410 | 2,430  | 230,000 |
| 1915-16 | 181    | 2,330   | 15,000 | 254,000 | 32,389  | 31,100 | 30,935  | 1,680  | 415    | 2,510  | 15,820 | 9,140  | 395,500 |
| 1916-17 | 15,400 | 1,080   | 2,100  | 32,700  | 20,900  | 8,820  | 132,200 | 5,760  | 851    | 84,000 | 9,339  | 5,850  | 319,000 |
| 1917-18 | 1,300  | 1,200   | 1,400  | 2,100   | 7,500   | 94,500 | 1,000   | 500    | 500    | 1,600  | 9,000  | 1,600  | 122,200 |
| 1918-19 | 900    | 2,000   | 3,100  | 2,000   | 7,500   | 20,000 | 13,500  | 700    | 300    | 64,000 | 34,000 | 14,500 | 162,500 |
| 1919-20 | 1,920  | 180,000 | 16,400 | 80,400  | 128,900 | 22,380 | 7,540   | 4,260  | 720    | 2,100  | 11,280 | 10,100 | 466,000 |
| 1920-21 | 1,030  | 4,380   | 2,400  | 1,780   | 3,110   | 1,300  | 1,506   | 124    | 110    | 21,000 | 20,660 | 8,600  | 66,000  |
| 1921-22 | 34,732 | 1,024   | 14,200 | 93,984  | 65,070  | 65,990 | 6,520   | 1,840  | 1,640  | 2,780  | 5,120  | 13,100 | 306,000 |
| 1922-23 | 1,308  | 1,408   | 5,272  | 724     | 4,152   | 57,136 | 6,316   | 3,150  | 2,330  | 3,972  | 4,888  | 52,344 | 143,000 |
| 1923-24 | 78     | 6,524   | 74,595 | 16,800  | 2,683   | 6,320  | 17,300  | 1,149  | 923    | 972    | 7,351  | 7,805  | 142,500 |
| 1924-25 | 2,122  | 1,518   | 4,524  | 1,116   | 1,080   | 1,140  | 1,128   | 814    | 1,138  | 6,492  | 10,404 | 11,524 | 43,000  |
| 1925-26 | 1,100  | 1,050   | 2,200  | 2,700   | 4,100   | 9,050  | 72,000  | 17,700 | 1,200  | 6,100  | 24,300 | 22,700 | 164,200 |
| 1926-27 | 6,000  | 4,000   | 40,000 | 1,000   | 170,000 | 24,000 | 23,000  | 2,000  | 1,000  | 800    | 24,084 | 31,116 | 327,000 |
| 1927-28 | 1,760  | 540     | 3,662  | 2,170   | 9,378   | 2,040  | 2,824   | 2,351  | 1,528  | 1,650  | 9,861  | 2,017  | 39,781  |
| 1928-29 | 1,597  | 263     | 563    | 580     | 430     | 344    | 5,334   | 78     | 134    | 586    | 4,540  | 8,808  | 23,257  |
| 1929-30 | 372    | 240     | 248    | 1,196   | 634     | 8,630  | 2,168   | 426    | 214    | 4,885  | 9,403  | 6,039  | 34,460  |
| 1930-31 | 413    | 6,443   | 558    | 640     | 56,082  | 896    | 443     | 296    | 240    | 5,407  | 29,444 | 2,185  | 103,047 |
| 1931-32 | 1,693  | 1,029   | 6,236  | 1,711   | 58,084  | 9,147  | 572     | 350    | 300    | 963    | 3,370  | 732    | 84,193  |
| 1932-33 | 2,006  | 315     | 1,100  | 9,229   | 2,640   | 4,363  | 964     | 834    | 775    | 1,759  | 3,112  | 5,400  | 32,497  |
| 1933-34 | 1,300  | 494     | 297    | 265     | 228     | 374    | 224     | 175    | 192    | 383    | 8,690  | 910    | 13,532  |
| 1934-35 | 214    | 847     | 2,060  | 8,340   | 28,110  | 14,910 | 2,070   | 242    | 840    | 3,450  | 9,250  | 8,400  | 78,733  |
| 1935-36 | 244    | 354     | 355    | 372     | 1,640   | 1,250  | 505     | 327    | 253    | 5,010  | 9,660  | 3,910  | 23,880  |
| 1936-37 | 606    | 298     | 1,060  | 4,340   | 58,200  | 41,830 | 2,130   | 56     | -1,430 | 1,300  | 2,170  | 1,280  | 111,840 |
| 1937-38 | 569    | 453     | 407    | 271     | 188     | 25,670 | 357     | 100    | 0      | 0      | 489    | 441    | 28,945  |
| 1938-39 | 266    | 109     | 5,360  | 405     | 1,250   | 1,880  | 642     | 0      | 0      | 0      | 2,640  | 17,370 | 29,922  |
| 1939-40 | 0      | 258     | 170    | 210     | 3,220   | 107    | 0       | 378    | 1,310  | 0      | 2,665  | 1,320  | 9,658   |
| 1940-41 | 4,535  | 0       | 23,314 | 11,792  | 16,872  | 73,414 | 68,240  | 3,840  | 837    | 4,510  | 4,100  | 1,960  | 213,414 |



| Year    | Oct.  | Nov.  | Dec.   | Jan.   | Feb.   | March  | April  | May   | June  | July  | August  | Sept.  | Total   |
|---------|-------|-------|--------|--------|--------|--------|--------|-------|-------|-------|---------|--------|---------|
| 1941-42 | 1,500 | 788   | 3,980  | 2,976  | 1,405  | 2,608  | 1,045  | 152   | 0     | 1,028 | 3,700   | 3,271  | 22,453  |
| 1942-43 | 1,276 | 678   | 488    | 1,624  | 252    | 2,207  | 155    | 92    | 54    | 125   | 11,599  | 3,399  | 21,949  |
| 1943-44 | 664   | 378   | 297    | 214    | 12,542 | 19,759 | 2,588  | 509   | 0     | 1,178 | 1,982   | 2,174  | 42,285  |
| 1944-45 | 196   | 657   | 927    | 1,474  | 5,241  | 19,944 | 4,189  | 499   | 1,028 | 2,281 | 4,041   | 242    | 40,719  |
| 1945-46 | 1,387 | 419   | 656    | 270    | 182    | 148    | 109    | 0     | 90    | 1,348 | 4,048   | 2,747  | 11,404  |
| 1946-47 | 660   | 560   | 1,288  | 548    | 168    | 97     | 0      | 157   | 66    | 64    | 3,870   | 78     | 7,556   |
| 1947-48 | 95    | 68    | 235    | 86     | 95     | 66     | 51     | 4     | 4     | 208   | 4,491   | 39     | 5,442   |
| 1948-49 | 30    | 28    | 721    | 15,250 | 8,049  | 6,087  | 1,870  | 0     | 468   | 517   | 962     | 2,239  | 36,221  |
| 1949-50 | 4,128 | 172   | 509    | 221    | 495    | 834    | 76     | 0     | 0     | 3,183 | 496     | 21     | 10,135  |
| 1950-51 | 71    | 56    | 47     | 779    | 68     | 88     | 118    | 83    | 0     | 782   | 101,810 | 562    | 104,464 |
| 1951-52 | 0     | 3,047 | 1,903  | 18,079 | 1,016  | 21,470 | 4,921  | 971   | 169   | 2,444 | 5,085   | 1,924  | 61,029  |
| 1952-53 | 315   | 495   | 647    | 374    | 185    | 422    | 202    | 37    | 790   | 4,755 | 2,001   | 174    | 10,397  |
| 1953-54 | 88    | 192   | 160    | 355    | 253    | 13,213 | 1,305  | 299   | 567   | 1,890 | 4,780   | 2,922  | 26,024  |
| 1954-55 | 55    | 99    | 134    | 352    | 257    | 343    | 218    | 136   | 3,456 | 6,264 | 16,675  | 359    | 28,348  |
| 1955-56 | 184   | 112   | 222    | 194    | 205    | 318    | 192    | 195   | 553   | 3,343 | 901     | 0      | 6,419   |
| 1956-57 | 141   | 125   | 166    | 11,124 | 4,444  | 1,146  | 146    | 148   | 246   | 223   | 235     | - 834  | 17,310  |
| 1957-58 | 256   | 4,406 | 229    | 205    | 5,076  | 9,959  | 2,450  | 115   | 547   | -16   | 1,478   | 12,135 | 36,840  |
| 1958-59 | 305   | 109   | 173    | 208    | 642    | 295    | 60     | 245   | 30    | 970   | 13,624  | -247   | 16,414  |
| 1959-60 | 5,127 | 725   | 19,283 | 8,620  | 1,971  | 1,723  | 410    | 341   | 465   | 554   | 4,555   | 1,813  | 45,587  |
| 1960-61 | 462   | 100   | 133    | 281    | 300    | 282    | 266    | 190   | 246   | 1,658 | 271     | 1,945  | 6,134   |
| 1961-62 | 164   | 61    | 208    | 1,324  | 2,553  | 3,603  | 548    | -46   | 82    | -594  | -1,257  | 265    | 6,911   |
| 1962-63 | 126   | 156   | 116    | 101    | 155    | 110    | 89     | 121   | 89    | 31    | 12,464  | 2,894  | 16,452  |
| 1963-64 | 72    | 724   | -51    | 68     | 132    | 1,689  | 571    | 99    | 0     | 604   | 8,425   | 419    | 12,752  |
| 1964-65 | 81    | 58    | 69     | 6,866  | 6,401  | 11,420 | 39,736 | 523   | -1    | 945   | 1,735   | 4,548  | 72,265  |
| 1965-66 | 363   | 5,695 | 89,150 | 11,470 | 8,793  | 6,100  | 1,698  | 1,267 | 793   | 1,356 | 2,383   | 6,285  | 135,353 |
| 1966-67 | 351   | 522   | 5,984  | 553    | 758    | 940    | 702    | 1,265 | 1,157 | 2,489 | 4,255   | 1,756  | 20,732  |
| 1967-68 | 424   | 555   | 50,074 | 13,974 | 21,610 | 6,151  |        |       |       |       |         |        |         |



MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NUMBER ONE

Recapitulation of Monthly Inflow Measured in Acre Feet at  
Lake Pleasant Storage Reservoir for Period from October 1911 through September 1967

| <u>Oct.</u> | <u>Nov.</u> | <u>Dec.</u> | <u>Jan.</u> | <u>Feb.</u> | <u>March</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>July</u> | <u>Aug.</u> | <u>Sept.</u> | <u>TOTAL</u> |
|-------------|-------------|-------------|-------------|-------------|--------------|--------------|------------|-------------|-------------|-------------|--------------|--------------|
| 118,831     | 246,005     | 371,207     | 682,808     | 861,612     | 692,884      | 506,537      | 69,015     | 29,854      | 366,251     | 531,276     | 319,474      | 4,795,754    |
| 2.5         | 5.1         | 7.7         | 14.2        | 18.0        | 14.5         | 10.6         | 1.4        | 0.6         | 7.6         | 11.1        | 6.7          | 100          |

Recapitulation of Monthly Inflow Measured in Acre Feet at  
Lake Pleasant Storage Reservoir for Period from October 1929 through September 1967

| <u>Oct.</u> | <u>Nov.</u> | <u>Dec.</u> | <u>Jan.</u> | <u>Feb.</u> | <u>March</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>July</u> | <u>Aug.</u> | <u>Sept.</u> | <u>TOTAL</u> |
|-------------|-------------|-------------|-------------|-------------|--------------|--------------|------------|-------------|-------------|-------------|--------------|--------------|
| 30,312      | 31,154      | 168,839     | 122,387     | 288,786     | 307,342      | 142,036      | 14,426     | 14,430      | 65,297      | 299,627     | 101,080      | 1,585,716    |
| 1.9         | 2.0         | 10.6        | 7.7         | 18.2        | 19.4         | 9.0          | 0.9        | 0.9         | 4.1         | 18.9        | 6.4          | 100          |

# WINTER MONTHS RUNOFF - AGUA FRIA RIVER

| Near Mayer, Arizona |             |         |          |        |        |                 |                             |
|---------------------|-------------|---------|----------|--------|--------|-----------------|-----------------------------|
| Water<br>Year       | Acre - Feet |         |          |        |        |                 | Winter<br>as % of<br>Annual |
|                     | December    | January | February | March  | April  | Winter<br>Total |                             |
| 1959                | 86          | 114     | 267      | 153    | 117    | 737             | 7                           |
| 1960                | 3,790       | 2,830   | 268      | 191    | 149    | 7,228           | 77                          |
| 1961                | 53          | 23      | 18       | 18     | 17     | 129             | 2                           |
| 1962                | 66          | 93      | 156      | 179    | 59     | 553             | 53                          |
| 1963                | 12          | 12      | 8        | 12     | 7      | 51              | 1                           |
| 1964                | 148         | 157     | 51       | 1,120  | 79     | 1,555           | 14                          |
| 1965                | 45          | 1,870   | 1,630    | 3,470  | 13,940 | 20,955          | 94                          |
| 1966                | 27,840      | 1,570   | 490      | 598    | 235    | 30,733          | 91                          |
| Above Lake Pleasant |             |         |          |        |        |                 |                             |
| 1959                | 173         | 208     | 642      | 295    | 60     | 1,378           | 8                           |
| 1960                | 19,280      | 8,620   | 1,970    | 1,720  | 410    | 32,000          | 70                          |
| 1961                | 133         | 282     | 300      | 282    | 267    | 1,264           | 21                          |
| 1962                | 209         | 1,320   | 2,550    | 3,600  | 548    | 8,227           | 93                          |
| 1963                | 109         | 103     | 145      | 113    | 78     | 548             | 4                           |
| 1964                | 0           | 52      | 123      | 1,550  | 531    | 2,256           | 18                          |
| 1965                | 62          | 6,270   | 6,330    | 11,570 | 38,390 | 62,622          | 89                          |
| 1966                | 89,170      | 11,500  | 8,790    | 6,120  | 1,700  | 117,280         | 86                          |



## HYDROCLIMATOLOGY

### Section 2b - Floods

#### Corps of Engineer's Estimates 1/

An intensive survey and analysis has been completed by the Corps of Engineers for the Lower Agua Fria flood plain. The survey covered the 23 mile reach from a short distance below Waddell Dam to Camelback Road near Litchfield Park.

The Corps has established the magnitude of two future floods by two different criteria. The first type is the Intermediate Regional Flood which is a probability estimate of the 100 year occurrence based upon statistical analysis. This flood in the Agua Fria is estimated to peak at 59,000 c.f.s. below Waddell Dam and 95,000 c.f.s. at Camelback Road near Litchfield Park.

The second flood is the Standard Project Flood which is the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that can be expected in a particular geographical area.

The storm used in determining the S.P.F. for the Agua Fria is the one which occurred over the Queen Creek drainage on August 19, 1954. This storm produced over 5 inches of rainfall over an estimated 100 square mile area and 1 inch over 1,000 square miles. This rain came during a 6-hour period with the first 3 hours receiving the highest intensities. The estimated peak flow at the Whitlow Ranch damsite was 42,000 cubic feet per second.

The Queen Creek storm of August 1954 if centered over the Agua Fria Watershed would generate a flood peak of 65,000 c.f.s. below Waddell Dam and 190,000 c.f.s. at Camelback Road near Litchfield Park. The return frequency of such a flood is not known. It would be rare, although it could occur tomorrow.

The regulatory benefits of Waddell Dam were taken into account in developing both the Intermediate Regional and Standard Project discharges. U.S. Geological Water Supply Paper No. 1683.

This water supply paper entitled Magnitude and Frequency of Floods in the United States presents a procedure for predicting the magnitude of floods of specified frequency. Estimates obtained are based upon a statistical analysis of measured floods from similar hydro-geographical areas. Table 1 from W.S.P. No. 1683 lists recorded peak stages and discharges for the Agua Fria River near Mayer. Exhibits 1 and 2 provide curves for estimating flood peaks of varying frequencies for watersheds of different sizes above Waddell Dam.

1/ Flood Plain Information, Agua Fria River, Maricopa County, Arizona.  
U. S. Army Corps of Engineers, Los Angeles District, California.  
March 1966.



Estimating Magnitude and Frequency of Floods in the Agua Fria Watershed above Waddell Dam

The following curves are used to determine the mean annual flood and the discharge for a flood of a selected frequency anywhere along the Agua Fria drainage as long as the contributing drainage area is known.

Use of the curves -

1. Determine the size of the drainage area upstream from the site.
2. Determine the mean annual flood by use of the appropriate curve.
3. Determine the ratio of the flood of the selected recurrence interval to the mean annual flood on the flood frequency curve.
4. Multiply the ratio to the mean annual flood by the mean annual flood to obtain the discharge for the flood of the selected frequency.

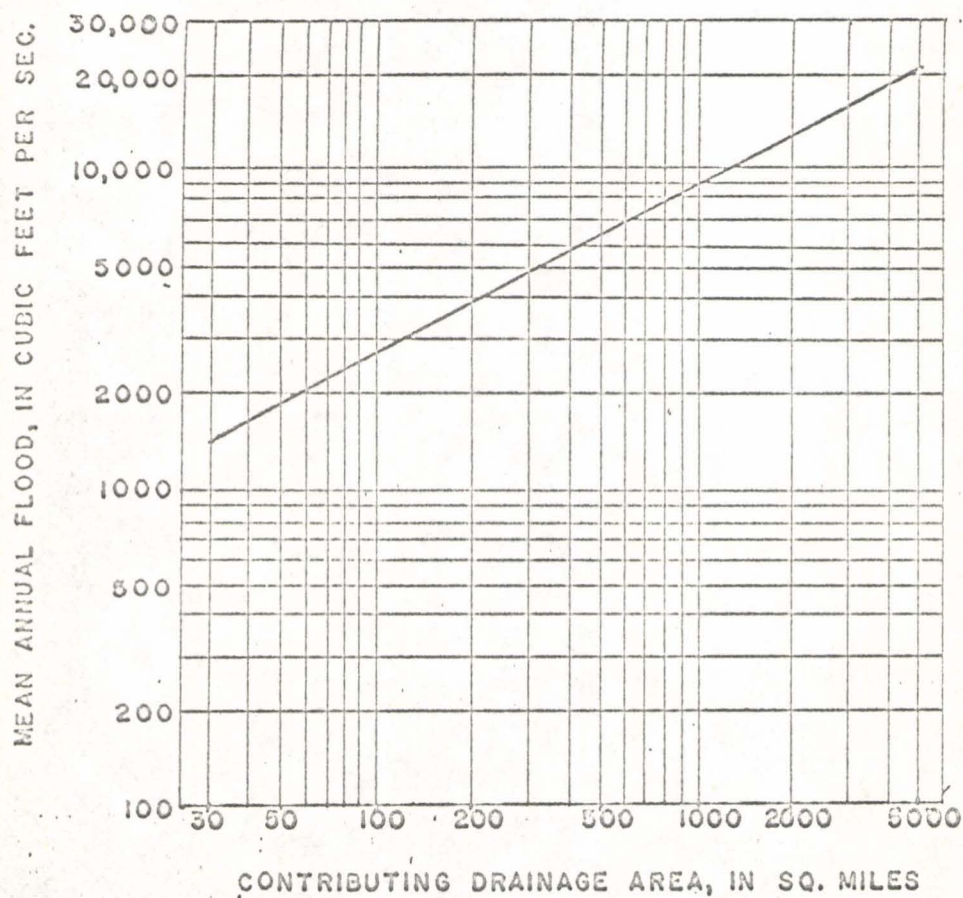
Example:

The magnitude and frequency of floods at Waddell Dam Site:

Contributing area = 1,459 sq. miles  
Mean annual flood = 10,000 cubic feet/sec.  
Recurrence interval = 10 years.  
Ratio of discharge to mean annual flood = 2.3  
Discharge of 10 year flood = 23,000 cubic feet/sec.

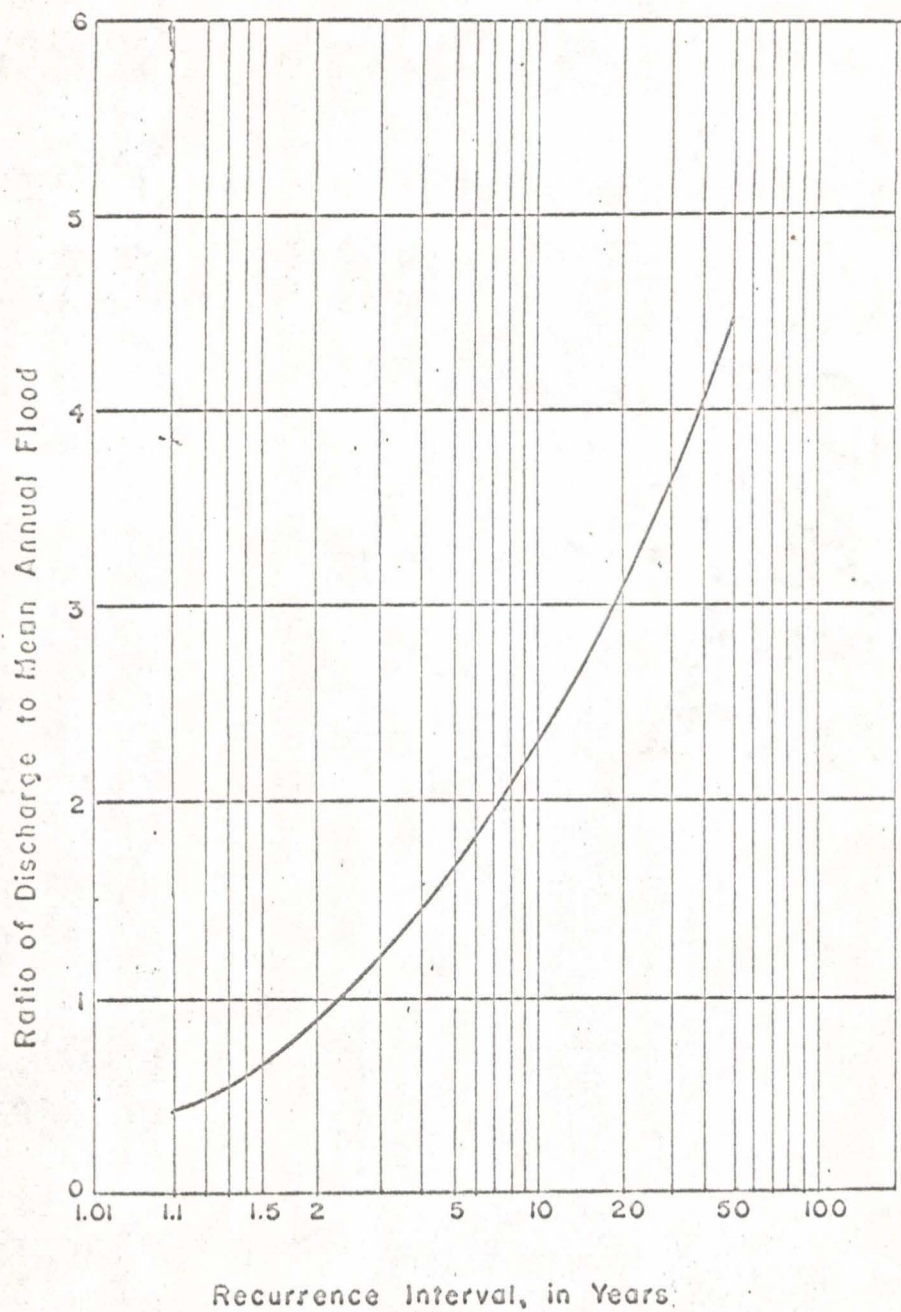


MEAN ANNUAL FLOOD  
AGUA FRIA WATERSHED



# FREQUENCY CURVE OF FLOODS

## AGUA FRIA WATERSHED





APPENDIX V

SEDIMENT

Tables 1a, 1b, and 1c show opportunities for decreasing sediment yields from National Forest Lands in conjunction with increasing water yield. The explanation of Table 1 by columns is as follows:

Column 1 - Hydrologic areas.

Column 2 - Total acres in each unit.

Column 3 - Acres treatable for conversion to grass to reduce erosion.

Column 4 - Percent of total decrease in sediment yield that can come from treatment for sheet erosion.

Column 5 - Miles of gullies suitable for treatment.

Column 6 - Percent of decrease in sediment yield that can come from gully treatment.

Column 7 - Miles of roads suitable for treatment.

Column 8 - Percent of decrease in sediment yield that can come from road repair.

Column 9 - Potential decrease in average annual sediment yields in thousands of tons. These figures are based on Musgraves formula for estimating amounts of sheet erosion. By substituting into the formula the vegetation cover before and after treatment, the difference is considered to be a decrease in sediment yield.



TABLE 1a

Potential Opportunities for Decreasing Sediment Yields from East Side Agua Fria, Prescott National Forest  
(In Conjunction with Increasing Water Yields)

| Hydrologic Area | Acres  | Sheet Erosion |     | Gullies |    | Roads |   | Potential Decrease in Average Annual Sediment Yields<br>(In Thousands of Tons) |
|-----------------|--------|---------------|-----|---------|----|-------|---|--------------------------------------------------------------------------------|
|                 |        | Acres         | K   | Acres   | K  | Miles | K |                                                                                |
| A3              | 979    | 881           | 99  |         |    | 2.0   | 1 | 0.62                                                                           |
| A10             | 486    | 437           | 32  | 3.6     | 68 |       |   | 0.76                                                                           |
| B2              | 3,424  | 3,082         | 91  |         |    | 4.0   | 9 | 0.13                                                                           |
| B4              | 5,626  | 5,063         | 99  |         |    | --    | 1 | 1.70                                                                           |
| B10             | 6,938  | 6,244         | 99  |         |    | 3.5   | 1 | 3.16                                                                           |
| B31             | 774    | 697           | 97  |         |    | 5.5   | 3 | 0.19                                                                           |
| C2              | 2,957  | 2,661         | 100 |         |    |       |   | 3.15                                                                           |
| C3              | 2,227  | 601           | 99  |         |    | 1.0   | 1 | 0.26                                                                           |
| C14             | 371    | 100           | 100 |         |    |       |   | 0.02                                                                           |
| C15             | 2,182  | 589           | 100 |         |    |       |   | 0.06                                                                           |
| C20             | 2,208  | 1,987         | 100 |         |    |       |   | 5.86                                                                           |
| D2              | 4,024  | 1,086         | --  |         |    |       |   | --                                                                             |
| TOTAL           | 32,874 | 23,611        |     | 3.6     |    | 16.0  |   | 15.96                                                                          |

TABLE 1b

Potential Opportunities for Decreasing Sediment Yields from West Side Agua Fria, Prescott National Forest  
(In Conjunction With Increasing Water Yields)

| Hydrologic Area | Acres   | Sheet Erosion |     | Gullies |   | Roads |    | Potential Decrease in<br>Average Annual Sediment Yields<br>(In Thousands of Tons) |
|-----------------|---------|---------------|-----|---------|---|-------|----|-----------------------------------------------------------------------------------|
|                 |         | Acres         | K   | Acres   | K | Miles | K  |                                                                                   |
| A1              | 7,559   | 6,803         | 99  |         |   | --    | 1  | 1.88                                                                              |
| A2              | 737     | 663           | 98  |         |   | --    | 2  | 1.01                                                                              |
| A3              | 2,675   | 2,407         | 99  |         |   | --    | 1  | 0.34                                                                              |
| B2              | 1,215   | 1,094         | 79  |         |   | --    | 21 | 0.45                                                                              |
| B6              | 10,400  | 9,360         | 100 |         |   |       |    | 4.31                                                                              |
| B7              | 25,802  | 23,222        | 100 |         |   |       |    | 19.73                                                                             |
| B8              | 7,227   | 6,504         | 100 |         |   |       |    | 13.19                                                                             |
| B11             | 19,273  | 17,346        | 98  |         |   | --    | 2  | 10.80                                                                             |
| C3              | 8,686   | 2,345         | 85  |         |   | --    | 15 | 0.53                                                                              |
| C4              | 628     | 169           | 70  |         |   | --    | 30 | 0.03                                                                              |
| C8              | 663     | 597           | 100 |         |   |       |    | 0.85                                                                              |
| C11             | 58,628  | 52,765        | 100 |         |   |       |    | 87.35                                                                             |
| C12             | 2,746   | 741           | 94  |         |   | --    | 6  | 0.06                                                                              |
| C13             | 1,002   | 902           | 85  |         |   | --    | 15 | 0.06                                                                              |
| C14             | 426     | 383           | 95  |         |   | --    | 5  | 0.05                                                                              |
| C16             | 2,613   | 705           | 76  |         |   | --    | 24 | 0.08                                                                              |
| D2              | 6,183   | 1,669         | 47  |         |   | --    | 53 | 0.14                                                                              |
| D3              | 5,158   | 1,392         | 45  |         |   | --    | 55 | 0.10                                                                              |
| D4              | 355     | 319           | 100 |         |   |       |    | 0.30                                                                              |
| TOTAL           | 161,976 | 129,386       |     |         |   |       |    | 141.26                                                                            |



TABLE 1c

Potential Opportunities for Decreasing Sediment Yields from Tonto National Forest  
(In Conjunction With Increasing Water Yields)

| Hydrologic<br>Area | Acres | Sheet Erosion |    | Gullies |    | Roads |    | Potential Decrease in<br>Average Annual Sediment Yields<br>(In Thousands of Tons) |
|--------------------|-------|---------------|----|---------|----|-------|----|-----------------------------------------------------------------------------------|
|                    |       | Acres         | K  | Acres   | K  | Miles | K  |                                                                                   |
| B2                 | 1,229 | 1,106         | 99 |         |    | 1.7   | 1  | 0.727                                                                             |
| B8                 | 1,978 | 0             |    | 1.6     | 65 | 3.6   | 35 | 0.036                                                                             |
| C3                 | 8,115 | 7,304         | 99 |         |    | 2.8   | 1  | 7.437                                                                             |
| TOTAL              | 4,022 | 8,410         |    | 1.6     |    | 8.1   |    | 8.200                                                                             |

TABLE 2

Summary of Project Work Inventory on the Prescott National Forest  
 Agua Fria Watershed

| FWI<br>Category<br>No. | Project Work Inventory<br>Category Name                         | Chino Valley<br>WS-7 | Verde<br>WS-7 | Crown King<br>WS-6 | Prescott<br>WS-6 | TOTAL        |
|------------------------|-----------------------------------------------------------------|----------------------|---------------|--------------------|------------------|--------------|
| 131                    | Restoration Measures<br>Gully Stabilization                     | 15 Miles             | 85 Miles      | 6.9 Miles          | 7 Miles          | 113.9 Miles  |
| 132                    | Restoration Measures<br>Sheet Erosion Control                   | 4,000 Acres          | 80,000 Acres  | 30 Miles           | 4,500 Acres      | 88,530 Acres |
| 135                    | Restoration Measures<br>Rehab. of Abandoned<br>Roads and Trails | 5.0 Miles            | 30 Miles      | 200 Miles          | --               | 235 Miles    |
| 136                    | Restoration Measures<br>Mining                                  | 100 Acres            | --            | --                 | 100 Acres        | 200 Acres    |
| 138                    | Restoration Measures<br>Pollution Abatement                     | --                   | --            | 5.0 Miles          | 6 Miles          | 11.0 Miles   |
| 139                    | Water Yield Improvement<br>Type Conversion                      | --                   | --            | 5,000 Acres        | --               | 5,000 Acres  |
| 143                    | Water Yield Improvement<br>Water Spreading                      | 4,000 Acres          | 18,000 Acres  | 500 Acres          | --               | 22,800 Acres |

WS-6 = West Side Agua Fria Watershed

WS-7 = East Side Agua Fria Watershed

The above Table is a summary of the watershed projects proposed on the Agua Fria Watershed. Projects are listed under the four Ranger Districts on the Agua Fria Drainage and gives the miles or acres in each type of project. The units shown are total projects on the District and not individual work projects.



Table 3

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

RESERVOIR SEDIMENTATION  
DATA SUMMARY

Lake Pleasant

(D) - 1

NAME OF RESERVOIR

DATA SHEET NO.

|                                    |                                                                 |                                        |                                    |                                         |                                            |                                 |                           |                                   |
|------------------------------------|-----------------------------------------------------------------|----------------------------------------|------------------------------------|-----------------------------------------|--------------------------------------------|---------------------------------|---------------------------|-----------------------------------|
| DAM                                | 1. OWNER <u>Maricopa County Mun. Water Conserv. Dist. No. 1</u> |                                        |                                    |                                         | 2. RIVER <u>Agua Fria River</u>            |                                 | 3. STATE <u>Arizona</u>   |                                   |
|                                    | 4. SEC. - TWP. - RANGE -                                        |                                        |                                    |                                         | 5. NEAREST TOWN <u>95 MI. NW Phoenix</u>   |                                 | 6. COUNTY <u>Maricopa</u> |                                   |
| RESERVOIR                          | 7. STREAM BED ELEV. -                                           |                                        |                                    |                                         | 8. TOP OF DAM ELEV. -                      |                                 | 9. SPILLWAY CREST ELEV. - |                                   |
|                                    | 10. STORAGE ALLOCATION                                          | 11. ELEVATION TOP OF POOL              | 12. SURFACE AREA ACRES             | 13. STORAGE ACRE-FEET                   | 14. ACCUMULATED ACRE-FEET                  | 15. DATE STORAGE BEGAN          |                           |                                   |
|                                    | a. FLOOD CONTROL                                                |                                        |                                    |                                         |                                            | April 1928                      |                           |                                   |
|                                    | b. POWER                                                        |                                        |                                    |                                         |                                            |                                 |                           |                                   |
|                                    | c. WATER SUPPLY                                                 |                                        |                                    |                                         |                                            | 16. DATE NORMAL OPER. BEGAN     |                           |                                   |
|                                    | d. IRRIGATION                                                   |                                        | 3,693                              | 181,500                                 | 181,500                                    |                                 |                           |                                   |
|                                    | e. CONSERVATION                                                 |                                        |                                    |                                         |                                            |                                 |                           |                                   |
|                                    | f. INACTIVE                                                     |                                        |                                    |                                         |                                            |                                 |                           |                                   |
|                                    | 17. LENGTH OF RESERVOIR                                         |                                        |                                    |                                         | MILES                                      | AV. WIDTH OF RESERVOIR          |                           | MILES                             |
|                                    | WATERSHED                                                       | 18. TOTAL DRAINAGE AREA                |                                    | 1,150                                   | SQ. MI.                                    | 22. MEAN ANNUAL PRECIPITATION   |                           | INCHES                            |
| 19. NET SEDIMENT CONTRIBUTING AREA |                                                                 | 1,444                                  | SQ. MI.                            | 23. MEAN ANNUAL RUNOFF                  |                                            | INCHES                          |                           |                                   |
| 20. LENGTH                         |                                                                 | MILES                                  | AV. WIDTH                          | MILES                                   | 24. MEAN ANNUAL RUNOFF                     |                                 | AC.-FT.                   |                                   |
| 21. MAX. ELEV.                     |                                                                 | MIN. ELEV.                             |                                    | 25. CLIMATIC CLASSIFICATION <u>Arid</u> |                                            |                                 |                           |                                   |
|                                    |                                                                 |                                        |                                    |                                         |                                            |                                 |                           |                                   |
| SURVEY DATA                        | 26. DATE OF SURVEY                                              | 27. PERIOD YEARS                       | 28. ACCL. YEARS                    | 29. TYPE OF SURVEY                      | 30. NO. OF RANGES OR CONTOUR INT.          | 31. SURFACE AREA ACRES          | 32. CAPACITY ACRE-FEET    | 33. C/N RATIO AC.-FT. PER SQ. MI. |
|                                    | April 1928                                                      | -                                      | -                                  | -                                       | -                                          | 3,693                           | 181,500                   | 127                               |
|                                    | Feb. 1941                                                       | 12.9                                   | 12.9                               | Range Recon.                            | 8                                          | 3,693                           | 176,456                   | 122                               |
|                                    | 26. DATE OF SURVEY                                              | 34. PERIOD ANNUAL PRECIPITATION        | 35. PERIOD WATER INFLOW ACRE-FEET  |                                         |                                            | 36. WATER INFL. TO DATE AC.-FT. |                           |                                   |
|                                    |                                                                 |                                        | a. MEAN ANNUAL                     | b. MAX. ANNUAL                          | c. PERIOD TOTAL                            | d. MEAN ANNUAL                  | e. TOTAL TO DATE          |                                   |
|                                    |                                                                 |                                        |                                    |                                         |                                            |                                 |                           |                                   |
|                                    | 26. DATE OF SURVEY                                              | 37. PERIOD SEDIMENT DEPOSITS ACRE-FEET |                                    |                                         | 38. TOTAL SED. DEPOSITS TO DATE ACRE-FEET. |                                 |                           |                                   |
|                                    |                                                                 | a. PERIOD TOTAL                        | b. AV. ANNUAL                      | c. PER SQ. MI.-YEAR                     | d. TOTAL TO DATE                           | e. AV. ANNUAL                   | f. PER SQ. MI.-YEAR       |                                   |
|                                    | Feb. 1941                                                       | 8,014                                  | 621                                | 0.432                                   | 8,014                                      | 621                             | 0.432                     |                                   |
|                                    | 26. DATE OF SURVEY                                              | 39. AV. DRY WGT. LOS. PER CU. FT.      | 40. SED. DEP. TONS PER SQ. MI.-YR. |                                         | 41. STORAGE LOSS PCT.                      |                                 | 42. SED. INFLOW PPM       |                                   |
|                                    |                                                                 | a. PERIOD                              | b. TOTAL TO DATE                   | c. AV. ANNUAL                           | d. TOT. TO DATE                            | e. PERIOD                       | f. TOT. TO DATE           |                                   |
| Feb. 1941                          |                                                                 |                                        |                                    | 0.34                                    | 4.36                                       |                                 |                           |                                   |



TABLE 4

## Summary of SCS Sediment Source Map\*

| Sediment<br>Rate | West Side Agua Fria |                  |               | East Side Agua Fria |                  |               | Tonto National Forest |                  |               | Other Lands      |                  |               | Total            |
|------------------|---------------------|------------------|---------------|---------------------|------------------|---------------|-----------------------|------------------|---------------|------------------|------------------|---------------|------------------|
|                  | Area<br>Sq.Miles    | Sediment<br>Tons | % of<br>Total | Area<br>Sq.Miles    | Sediment<br>Tons | % of<br>Total | Area<br>Sq.Miles      | Sediment<br>Tons | % of<br>Total | Area<br>Sq.Miles | Sediment<br>Tons | % of<br>Total | Sediment<br>Tons |
| 0.01-0.2         | 71.93               | 7.19             | 1%            | 158.40              | 15.84            | 2%            | 42.62                 | 4.26             | 1%            | 69.81            | 6.98             | 1%            | 34.27            |
| 0.2 -0.5         | 187.58              | 65.65            | 10%           | 72.05               | 25.22            | 3%            | 36.18                 | 12.66            | 1%            | 151.94           | 53.18            | 9%            | 156.61           |
| 0.5 -1.0         | 8.83                | 6.62             | 1%            | 45.97               | 34.48            | 6%            | 10.32                 | 7.74             | 1%            | 588.39           | 441.29           | 64%           | 562.98           |
| TOTAL            | 268.34              | 79.47            | 12%           | 276.42              | 75.54            | 11%           | 89.12                 | 24.66            | 3%            | 810.14           | 501.45           | 74%           | 681.12           |

Forest lands produce 26% of the sediment produced on the Watershed. Lands outside the Forest boundary, although they consist of 55% of the land area, produce 74% of the sediment.

\* Sediment Source Map - Map prepared by Wm. Mildner and George Wendt of Soil Conservation Service - December 1967.



APPENDIX VI  
WATER QUALITY

## WATER QUALITY

The Prescott National Forest has set up three water quality stations on Forest Service lands in the Agua Fria Watershed. These stations are sampled approximately every three months. The stations are Lynx Lake, Horsethief Basin, and Sycamore Creek. Included in this report is the data of these readings started in 1967.

Lynx Lake is a water quality problem area. Sediment from mine dumps on private lands within the watershed have a high percent of copper and sulfates. These are dissolved in the water entering the Lake, which contains as high as 200 parts per million of copper. In addition, large amounts of sediment are being deposited which reduce the storage capacity of the Lake. A watershed condition survey is presently underway on this watershed.



TABLE 1

Water Quality Monitoring Stations  
Within the Agua Fria Watershed

| Chemical                         | Lynx Lake   |              | Sycamore Creek |              | Horsethief Basin |              |
|----------------------------------|-------------|--------------|----------------|--------------|------------------|--------------|
|                                  | 10/26/67    | 2/12/68      | 11/24/67       | 2/13/68      | 10/25/67         | 4/13/68      |
| Date/Time                        | 0900        | 0915         | 1000           | 1030         |                  |              |
| Alkalinity<br>(PPTH)<br>(M.O.)   | 0.0<br>70   | 0.0<br>50    | 0.0<br>330     | 0.0<br>80    | 0.0<br>60        | 0.0<br>20    |
| Carbon<br>Dioxide                | Less than 4 | Less than 4  | Less than 4    | Less than 4  | Less than 4      | Less than 4  |
| Chloride                         | 7.0         | 5.0          | 20.0           | 2.5          | 10               | 5            |
| Chlorine                         | --          | 0.0          | 0.025          | 0.0          | 0.0              | 0.0          |
| Chromate                         | --          | 0.13         | --             | 0.14         | 0.05             | 0.1          |
| Copper                           | 0.0         | 0.25         | 0.15           | 0.0          | 0.05             | 0.0          |
| Detergents                       | 0.0         | 0.02         | 0.0            | 0.0          | 0.0              | 0.0          |
| Flouride                         | --          | 0.2          | --             | 0.1          | --               | --           |
| Hardness<br>(Calcium)<br>(Total) | 120<br>150  | 70<br>110    | 210<br>320     | 50<br>90     | 30<br>40         | 20<br>20     |
| Hydrogen<br>Sulfide              | 0.0         | 0.0          | 0.0            | 0.0          | 0.0              | 0.0          |
| Iron                             | 0.0         | 0.8          | 0.0            | 0.1          | 0.6              | 0.6          |
| Manganese                        | 0.0         | 1.0          | 0.75           | 0.75         | 0.5              | 0.2          |
| Nitrate                          | --          | 0.0          | --             | 0.0          | --               | 0.0          |
| Dissolved<br>Oxygen              | --          | 14           | 5.0            | 15.5         | --               | 11.5         |
| PH                               | 7.3         | 7.8          | 8.4            | 8.4          | 7.8              | 7.1          |
| Silica                           | --          | 5.2          | --             | 3.2          | --               | 5.2          |
| Sulfate                          | 140         | 55           | 9.0            | 11.0         | 8.0              | 52           |
| Turbidity                        | 17          | 40           | 20             | 30           | 30               | 26           |
| Flow<br>Temp.<br>Water           | Low<br>54°F | Med.<br>42°F | Low<br>52°F    | Med.<br>42°F | Low<br>60°F      | Med.<br>51°F |
| Temp. Air                        | 61°F        | 46°F         | 58°F           | 52°F         | 74°F             | 52°F         |



SEDIMENT SOURCE MAP

U.A.F.B. S.C.D.

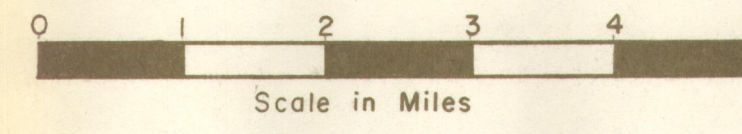
LEGEND

0.01 - 0.2 tons/sq. mile/year

0.2 - 0.5 tons/sq. mile/year

0.5 - 1.0 tons/sq. mile/year

Developed from general soil map of Upper Agua Fria Basin Soil Conservation District.  
Based on 1965 measured sediment deposits in Lake Pleasant.  
Map prepared by Wm. Mildner and George Wendt, Soil Conservation Service - December 1967



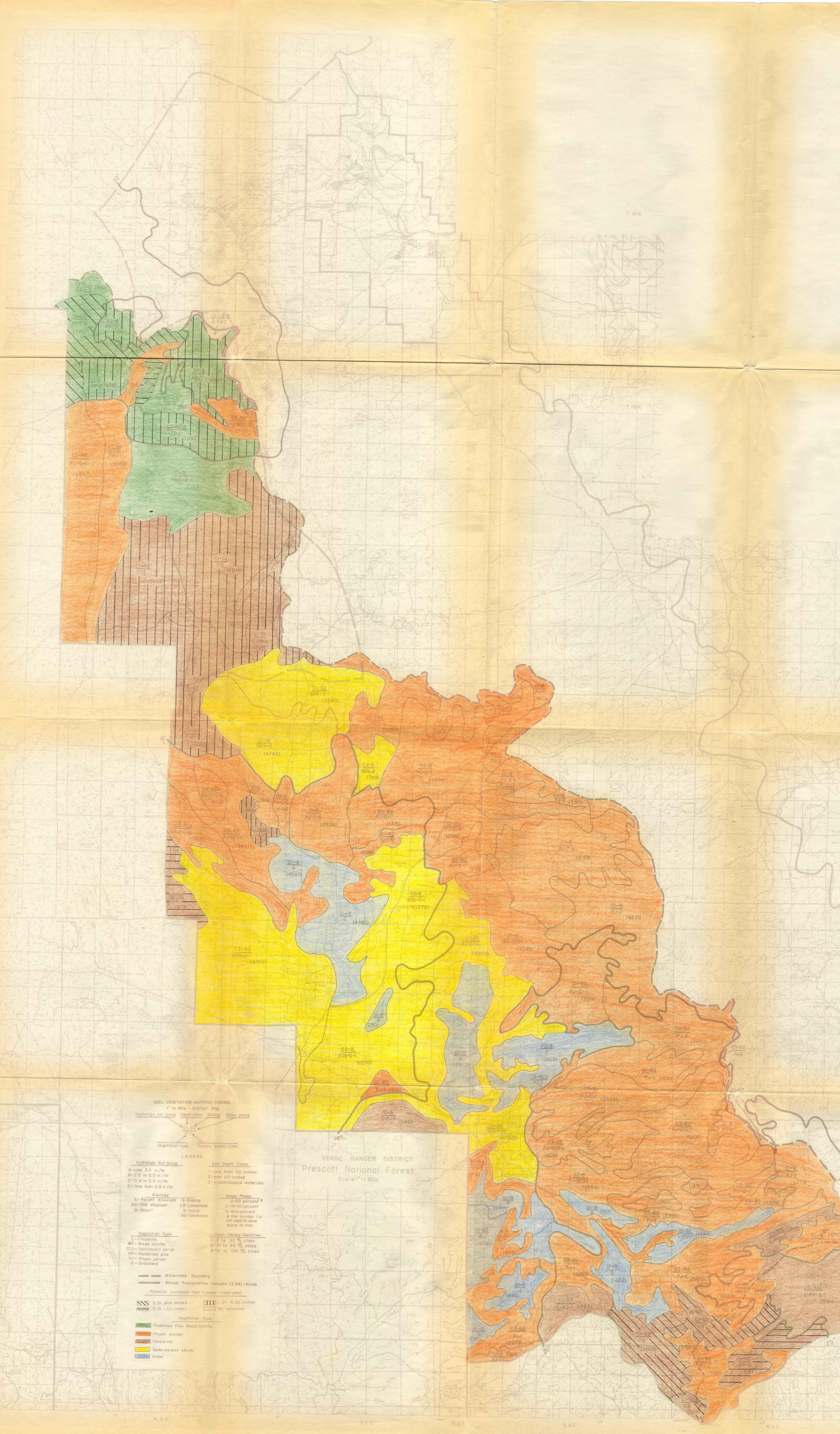
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LAKE PLEASANT

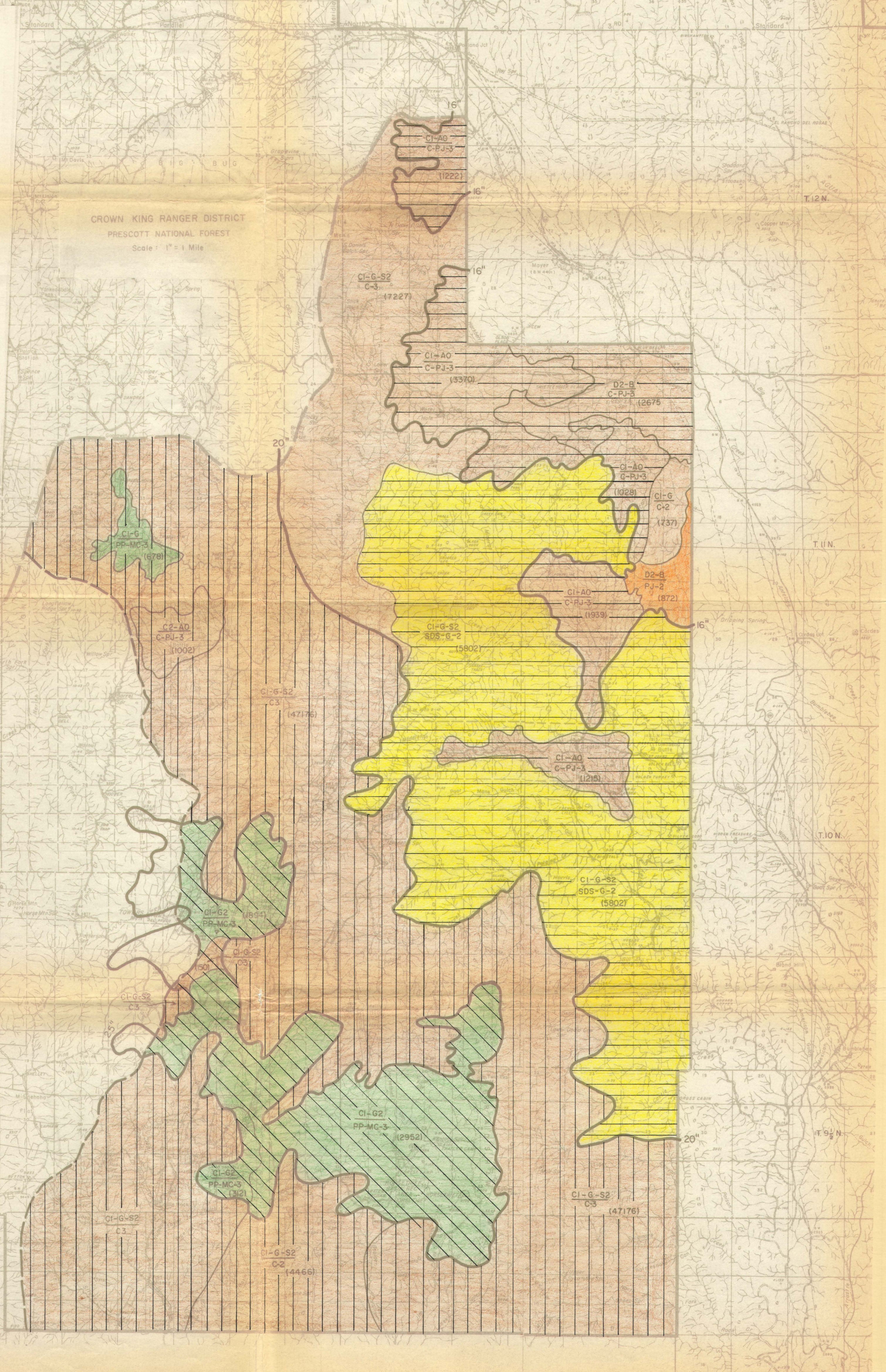




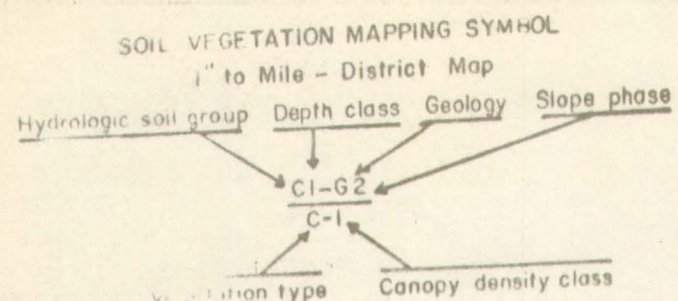












**LEGEND**

|                              |                             |                                                 |
|------------------------------|-----------------------------|-------------------------------------------------|
| <b>Hydrologic Soil Group</b> | <b>Soil Depth Class</b>     | <b>Slope Phase</b>                              |
| A - over 5.0 in/hr           | 1 - less than 20 inches     | 0-30 percent                                    |
| B - 2.5 to 5.0 in/hr         | 2 - over 20 inches          | 2-30-60 percent                                 |
| C - 0.6 to 2.5 in/hr         | 3 - miscellaneous materials | 3-60+ percent                                   |
| D - less than 0.6 in/hr      |                             | * the number 1 is not used to save space on map |

|                     |                        |
|---------------------|------------------------|
| <b>Geology</b>      | <b>Vegetation Type</b> |
| A - Recent alluvium | C - Chaparral          |
| AO - Old alluvium   | MC - Mixed conifer     |
| B - Basalt          | SDS - Semidesert shrub |
|                     | PP - Ponderosa pine    |
|                     | PJ - Pinyon-juniper    |
|                     | G - Grassland          |

|                               |
|-------------------------------|
| <b>Crown Canopy Densities</b> |
| 1-0 to 30 % class             |
| 2-31 to 60 % class            |
| 3-61 to 100 % class           |

